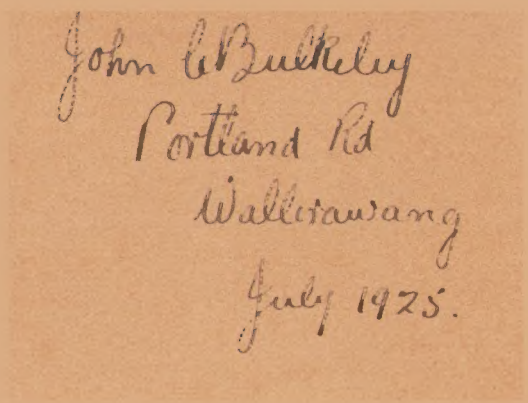
John G Buckley
Portland Rd
Wallerawang
July 1925.

THE ILLUSTRATED
AUSTRALIAN ENCYCLOPAEDIA

THE ILLUSTRATED AUSTRALIAN ENCYCLOPÆDIA

Edited by
ARTHUR WILBERFORCE JOSE
Author of *A History of Australia from the Earliest Times*
and
HERBERT JAMES CARTER
President of the Linnean Society of New South Wales

VOL. I
A TO LYS.

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PREFACE

THIS Encyclopaedia was first projected in 1912 as a historical and biographical record, under the editorship of Mr. Charles H. Bertie, Municipal Librarian at Sydney, and much material had been collected when the outbreak of war in 1914 temporarily halted its progress.

In 1917 work was resumed, and it was decided to include articles on scientific subjects also. For this section of the work we were fortunate to obtain the services of Mr. Herbert J. Carter, B.A. (Cantab.), F.E.S., President (1925) of the Linnean Society of New South Wales, who was able to secure the co-operation of the leading men of science in Australia. Their contributions are, in many instances, the first trustworthy summaries yet published of scientific knowledge previously accessible only in the journals of learned societies. In 1920 Captain Arthur Jose, just released from the Intelligence Branch of the Australian Navy Office, undertook the general editorship, and found that, owing partly to the lapse of time, partly to the opening up of fresh sources of information, it had become necessary to re-write much of the historical and biographical matter. Miss Persia Campbell, M.A. (Syd.), M.Sc. (Lond.), joined the staff in 1923.

These delays, however, proved beneficial in that they have enabled us to embody a great deal of information, both historical and scientific, that has but recently come to light. The utmost possible use has been made of original documents, especially of those contemporaneous with the events they describe; and for most of these we are indebted to the magnificent collection housed in the Mitchell Library at Sydney. Our work has been greatly facilitated, also, by the existence of two invaluable Commonwealth publications—the *Historical Records of Australia,* and the *Official Year Book of the Commonwealth.*

A special debt of gratitude for untiring help is due to Mr. Henry Selkirk, formerly keeper of archives in the New South Wales Department of Lands; to Captain Francis J. Bayldon, R.N.R.; and to the Principal Librarian (Mr. W. H. Ifould), Curator (Mr. Hugh Wright), and staff of the Mitchell Library. We are grateful also to the Trustees of the Australian Museum for granting the use of bird-drawings made by the late Neville H. P. Cayley; to Dr. Charles Anderson and the staff of the Museum for their personal help in ensuring accuracy; to the departmental officials of various States for help willingly rendered; to Dr. J. S. Battye (W.A.), Dr. Cumbrae Stewart (Q.), the late Mr. Thomas Gill (S.A.), Mr. A. W. Greig (Vic.), and Mr. Thomas Dunbabin (Tas.), for the general supervision of articles concerning their

respective States; to the Linnean Society of New South Wales for the drawings reproduced on pp. 152 and 715; to the authorities of the Sydney Technological Museum for permission to reproduce the coloured drawings of fishes; to Mr. William Dixson for help in solving difficult historical problems; and to innumerable correspondents for the patience and industry which they have exercised in furnishing the information we required.

We regret deeply the loss of much-valued contributors, notably of Professor W. A. Haswell, the eminent biologist; of Mr. Walter Jeffery, an indefatigable historian; of the Rev. W. W. Watts, the authority on Australian ferns; of Mr. H. G. Smith, F.C.S., and of Mr. W. J. Rainbow, F.E.S. Mr. Jeffery's articles have been revised by Captain Bayldon, and Mr. Watts's by Mr. Edwin Cheel. An article by the late T. F. Furber, on Geodesy, has been revised by Mr. D. S. Sawkins. The botanical matter generally is the work of Mr. J. H. Maiden, I.S.O., F.R.S., in collaboration with Mr. A. A. Hamilton. Most of the other articles bear the initials of their authors. For all other matter the editorial staff is responsible.

We take pride in publishing an encyclopaedia conceived, written, edited, printed and produced entirely within the Commonwealth of Australia, to the production of which the skilful and assiduous work of Mr. T. J. Bermingham of the Eagle Press has materially contributed.

ANGUS AND ROBERTSON

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COAT OF ARMS OF THE COMMONWEALTH
(after the official design)

A

Abbott, EDWARD (1772-1844), was born in England, and after youthful service in the 34th and 73rd regiments joined the New South Wales Corps (q.v.) on 5 June 1789 (lieutenant, 1789; captain, 1795; major, 1808). Reaching Sydney on 28 June 1790, he was sent to Norfolk Island for service under Lieutenant-governor King, and became town adjutant, inspector of outposts and (apparently) a sort of informal government architect. After helping King to suppress an incipient mutiny in 1794, he returned to Sydney and in 1795 was made commandant of the Hawkesbury district, receiving at the end of the year a commission as magistrate. In 1796 he took despatches from Governor Hunter to London. Returning towards the end of 1799, he was in the following year appointed engineer and artillery officer, and planned the first battery on Middle Head and some constructive work in Dawes Battery (see MILITARY DEFENCE). The next few years he spent partly at Norfolk Island, partly as commandant at Parramatta, and in January 1808 joined the committee that deposed Governor Bligh (q.v.); he was chosen by his party to be the new judge-advocate, but resigned at once. In 1810 he was sent to England by Macquarie to attend the court martial on Colonel Johnston, and shortly afterwards his name was removed from the army list.

Returning to Australia in 1813, he was made deputy-judge-advocate in Tasmania, with considerable powers of summary jurisdiction, and filled this office with distinction. On its abolition he visited England again, returning with the appointment of civil commandant at Launceston, and thus held the position of acting-governor of the island while Arthur was on active duty with troops during the 'Black War' of 1830 (see TASMANIA). He died on 17 January 1844.

Abbott, SIR JOSEPH PALMER (1842-1901), son of John Kingsmill Abbott, was born at Muswellbrook in New South Wales on 29 September 1842. A pastoralist as well as a solicitor, he entered local politics in 1880 as member for Gunnedah, which constituency he left in 1885 for Wentworth; during that year he held office as minister for mines in the Stuart ministry (7 January to 7 October) and minister for lands in the Dibbs ministry (7 November to 22 December). In October 1890 he was chosen as speaker of the legislative assembly. He was a delegate from New South Wales both to the federal convention of 1891, as a nominee, and to that of 1897-8, as one of the ten elected members. He resigned the speakership in 1900, and died in September of the following year. (K.C.M.G., 1892).—His son, JOHN HENRY MACARTNEY ABBOTT, born in 1874, is a well-known writer, whose sketches of foreign travel (*An Outlander in England, Letters from Queer Street*) and historical novels are a part of Australian literature. He served with the 1st Australian horse in the South African war, and in May 1900 was commissioned a lieutenant in the royal field artillery; his account of the Australian achievements in that war (*Tommy Cornstalk*) ranks with the best war literature of its time.

à Beckett, THOMAS TURNER (1808-1892), second son of William à Beckett, solicitor, and brother of Sir William à Beckett, elsewhere treated, was born in London on 13 September 1808 and educated at Westminster School. In 1829 he was admitted a solicitor and attorney, and joined his father in practice; in 1850 he migrated to Victoria, was admitted a solicitor in 1851, and took an active part in the public life of the colony. From 1854 to 1887 he was registrar of the diocese of Melbourne, and for much of that period was also a member of council of the local university and a trustee of the public library. In 1852-5 he was a nominee

member of the legislative council, and in 1858 was elected by the Central Province to represent it in the new council—this seat he held until 1878; he was twice in office (without portfolio, 1860-1; commissioner of trade and customs, 1870-1), and in 1870 was chairman of an important royal commission on the civil service. He retired from political life in 1878, and from all public duties in 1887, and died on 1 July 1892.—His eldest son, THOMAS À BECKETT (1836-1919), was called to the English bar in 1859 and to the Victorian in 1860, was made a puisne judge of the Victorian supreme court in 1886, and frequently acted as chief justice. He died on 21 June 1919. (Kt. Bach., 1909.)

à Beckett. SIR WILLIAM (1806-1869), born in London on 28 July 1806, was the eldest son of William à Beckett, solicitor. Educated at Westminster School and trained for the bar, he was called in 1829, migrated to New South Wales in 1837, and for a short time edited the *Literary News*. In 1841 he was appointed solicitor-general of the colony, and in 1844 took a puisne judgeship and sat as primary judge in equity. In January 1846 he was transferred to the supreme court of the Port Phillip district, and, when that district became the colony of Victoria, was appointed its first chief justice. Ill-health forced him to resign in 1857; he returned to England in 1863, and died there on 27 June 1869. He is described by a contemporary (Edmund Finn) as cultured and intellectual, learned and impartial as a judge, charitable, tolerant, and an accomplished writer; but his extant writings are of no great value. (Kt. Bach., 1859)—His son, WILLIAM ARTHUR CALLENDER À BECKETT, born in 1833, was a figure in Victorian politics between 1868 and 1876.—His brother THOMAS TURNER À BECKETT is separately treated of. A younger brother, GILBERT ABBOTT À BECKETT (1811-1856), author of the *Comic History of England* and similar works, was a notable journalist of the early Victorian era, being on the original staff of *Punch*.

Aboriginal Languages. The existing material for the study of the aboriginal languages is of a very unsatisfactory nature. No exhaustive grammar of an Australian language has been published. Some of those with the fullest details are admitted by their compilers to be deficient; others contain internal evidence of the omission of many details. The best of the earlier grammars are the *Australian Grammar* of Threlkeld (1834), the Adelaide *Outlines* of Teichelmann and Schürmann (1840), the Western Australian *Descriptive Vocabulary* of Moore (1842), the Encounter Bay grammar of Meyer (1843), the Parnkalla grammar of Schürmann (1844), and the Murray River grammar of Moorhouse (1846), with those of Watson and Threlkeld (printed by Hale in 1844), and the Narrinyeri grammar of Taplin (1878). Much less satisfactory are Grey's notes on south-western Australian grammar (1840), Ridley's *Kamilaroi* (1875), Müller's grammar (1876-88), Gason's specimens of Dieri (1874), and the notes by Dawson and various writers on the Victorian dialects in Brough Smyth (1878). Fraser in 1892 reprinted Threlkeld's and Günther's grammars, and added one of Minyung. Among more recent works the Aranda of Kempe (1890), the Pittapitta (1897) and Kokoyimidir (1901) of Roth, and the Ngerrikudi of Hey (1903) leave little to be desired; whilst the notes of Planert on Aranda and Dieri supplement or complete those of Kempe and Gason. The *Report* of the Cambridge expedition to Torres Straits (1907) also deals in detail with the Mabuiag of the Straits and the Cape York languages. R. H. Mathews published short grammatical notes of a great many languages, but singularly failed to appreciate the necessity of a detailed account of the suffixes, which for the comparative study of languages like the Australian are most important. He gives usually only the number, gender and some cases of the noun, a brief account of the adjective, some forms of the pronouns (the interrogative and demonstrative often being without details) with the principal tenses of the verb and a few adverbs and prepositions. A few imperfect sketches of grammar are to be found in Curr, J. Mathew, and Spencer, and here and there in a few other places. Fairly full vocabularies, consisting usually of native word-lists with an English interpretation, accompany the grammars just named; in various books and journals there are many other vocabularies, which consist only of a limited number of English words with native equivalents.

Very few texts have been recorded in the native languages. The most extensive are those in Aranda and Loritya recorded by Strehlow. Some fragments of legends and songs appear in Brough Smyth, and others have been given by Mrs. Parker, Dawson, Taplin, Lauterer, J. Mathew, and Roth. Some specimens in Mabuiag are contained in the *Report* of the Cambridge expedition. The New Testament has been translated into Dieri by members of the Lutheran mission; the Bible Society has also issued translations of four gospels in Mabuiag and one in the allied Saibai. These represent the only effective translations in Australian languages. A portion of St. Luke's Gospel was translated into the language of the Lake Macquarie natives by Threlkeld, and into Wiradhuri by Günther; but these were only printed as literary curiosities long after the death of the translators and the disappearance of the tribes for which they were made. Some selections from the Scriptures in Narrinyeri by Taplin, and some paraphrases in Kamilroi and Dippil by Ridley, have also appeared. (Note that, though Ridley used the spelling 'Kamilaroi,' the shorter form is now generally adopted.) Part of the Church of England Liturgy was translated into Wiradhuri by Günther, and a few translations of prayers, etc., are found elsewhere.

UNITY OF THE SOUTHERN LANGUAGES.—Most of the earlier specimens of Australian languages were obtained from the southern parts of the continent, and it soon became apparent that a fairly large number of words were common to many vocabularies. The names for certain parts of the body, (head, ear, eye, nose, tooth, tongue, beard, hand and foot), some of the pronouns, and the numeral 'two' were especially prominent among these words. In the grammar, also, it was noted that the functions of words were indicated in all the languages by suffixes, and that such grammatical features as the dual number, the separate forms for 'we' to denote whether the person addressed is included or excluded, the declension of nouns, pronouns and adjectives by postfixes or post-positions, and the conjunction of verbs by suffixed particles, were common to all the languages; while sibilant sounds, the passive voice, and the higher numerals were absent. Thus the languages were very generally regarded as variants of one common form of speech, and proofs of their unity were adduced

by Grey, Moorhouse, and Latham, and generally accepted by late writers. The northern vocabularies published by Earl (1853-4) were too imperfectly known to become a disturbing factor; their diversity caused them to be set apart as Papuan. The non-agreement of the northern languages with those in the southern part of the continent, which was first indicated by W. Schmidt, has been confirmed since some languages of the Northern Territory and north-western Australia have become better known. Words of common occurrence in the south are not found in the northern languages; moreover, the northern vocabularies often show very little likeness between one language and another in the same region. In the Cape York Peninsula and in central Australia there is found a grammatical structure similar to that of the southern languages; but in the Northern Territory and north-western Australia the grammar is of an entirely different character. Functions of words are indicated by prefixes instead of suffixes; thus in Chowie we have *ngi nun-amur* I throw, *jou min-amur* thou throwest, where a southern language (Kamilroi) would have such an expression as *ngaia bumul-da* I beat, *nginda bumul-da* thou beatest. Some of the northern languages also show indications of a classification of nouns indicating gender, e.g. Kakadu; *roulu no-orkudua*, stringy-bark tree one male, *peindi wi-orkudua*, stone one female. Thus the Australian languages must be separated into two main divisions: (1) Northern Australian (Papuo-Australian), comprising the languages of north-western Australia, the Northern Territory, part of central Australia, and the Cape York Peninsula; and (2) Southern Australian (Australian proper), the languages of the remainder of the continent. It should be noted that the unity of the southern languages, so much insisted upon by early writers, is of a somewhat superficial character. It merely means that the vocabulary of any named language contains a certain number of words which are the same as, or similar to, those found in another language of the group, and that the word-formations and syntax are similar. But within this general likeness there is a great deal of variety, both in vocabulary and in formative particles; any one language is therefore generally unintelligible to the speakers of another, unless they are near neighbours. With regard to the northern languages, their great diversity in grammar and vocabulary shows that they must be regarded as an assemblage of distinct linguistic groups, with little or no relation to one another.

CLASSIFICATION OF THE LANGUAGES.—Classifications of the Australian languages were attempted by Curr and J. Mathew. Curr divided his collection of vocabularies into 22 books, each dealing with a separate region in which the languages were more or less related to each other. J. Mathew made a more precise grouping, based on the general characteristics of the languages and the distribution of certain words. A much more elaborate classification has been made by Schmidt. This is substantially the same as that of Mathew, though there is a difference in the order and arrangement of the groups. Mathew's arrangement of the southern languages is as follows:—

1. Victorian region embracing part of the Riverina in New South Wales, and the south-eastern corner of South Australia. This has two subdivisions: Eastern or Gippsland, and Western. 2. New South Wales and the south, centre, and east of Queensland. Subdivisions are, Eastern or Coast, and Western or Inland (west of the Dividing Range). 3. Western Australia and west-central Australia. Two subdivisions: North and South. 4. Languages of South Australia and east-central Australia: (including the west of New South Wales and the north-west of Queensland.

Schmidt classifies the southern languages thus:—

Division I.

1. The South-western Group (corresponding to Mathew's third group): (*a*) Yungar (in the south-western corner of Australia); (*b*) Central languages, (inland from west to south coast); (*c*) Luridya.

2. The South-central Group (corresponding to Mathew's fourth group): (*a*) Parnkalla-Tyura-Meyu sub-group; (*b*) Nulla; (*c*) Dieri-Yarraworka-Wonkamarra-Evelyn Creek sub-group; (*d*) The Darling languages; (*e*) Kana (western Queensland); (*f*) Koongeri-Birria.

3. Narrinyeri Group: (*a*) North; (*b*) South.

Division II.

Isolated Languages of the Upper Murray River District. (*a*) Lower Murray; (*b*) Murray Bend; (*c*) Murray, Darling and Lachlan Junction; (*d*) Bangerang; (*e*) Dhudhuroa; (*f*) Pallanganmiddah; (*g*) Emu-Mudjug; (*h*) The Victorian group. (These eight sections, with the Narrinyeri, correspond to Mathew's first group.) (*i*) Yuin-Kuri Group (coast of New South Wales from Victoria to 31° S.); (*j*) Wiradhuri-Kamilroi Group; (*k*) The East Coast Languages; (*l*) The North-central Group. (Of these (*i*) and (*h*) correspond to the Eastern, and (*j*) and (*l*) to the Western section of Mathew's second group.)

Mathew made one division of the northern languages: North Coast and Central Australia, including Cape York Peninsula and the north-west coast. Two subdivisions, Coast and Central.

Schmidt calls the same languages North Australian. He makes three divisions, according to the vocalic character of the final syllable: languages with words ending in any consonant; languages with words ending in r, l, n, ng, or m, or a vowel; and languages with an initial vowel and (in the north) possessing the sibilant.

In the first division he places nearly all the languages of north-western Australia and the Northern Territory; in the second, most of those in Cape York Peninsula; in the third, those of central Australia and the region towards the Gulf of Carpentaria.

PHONOLOGY.—There is no uniform system of orthography. Most of the earlier grammars adopted a system based upon Italian vowel-sounds and English consonantal-sounds; but in later works, and in a great majority of the vocabularies, words are spelled in all sorts of ways, without any indication of the sounds attached to the letters. Curr tried to get uniformity in his numerous vocabularies, but failed. His contributors 'spelt their vocabularies from the English point of view.' In many cases Curr substituted his own method, and thus added to the confusion. R. H. Mathews in his many grammars and vocabularies did not maintain a uniform orthography, even when dealing in different places with the same language. As an example of the vagaries of spelling the words given for 'fire' and 'water' by Curr in his 17 vocabularies of the Wiradhuri language may be quoted. 'Fire' is given as *ween* (seven times), *wunn* (three times), *wein* (twice) *wee* (twice),

win, we-ing and *waing.* 'Water' is *kaling* (twice), *kul'en* (twice), *kallee* (twice); also as *kalleen, galling, kalle, ka'ling, kalli, kullung, kaleen, kalun, karlin, karlee, gulli.* Other writers have written *wheen, wee-in,* and *we,* and *guleen, gulleen, culleen, cully, calleein, colleen, collin, cullie* and *calle.* In these circumstances the study of Australian phonology is beset with difficulties, which will not be removed until the sound-systems of some of the typical languages of each group have been properly studied, so as to form a proper basis for future enquiry.

The following sounds apparently occur in Australian languages.

Vowels: *a, (ah, a)*; *e (ay, ā, ai)*; *i (e, ee, y)*; *o (ow)*; *u (oo)*. These have the Italian sounds, the characters in brackets being often used in their place. Curr doubted the presence of the French *u*; but Schürmann uses *ü* (French *u*, German *ü*), and in the Northern Territory the German *ü* and *o* are both found.

Diphthongs: *ai (i, y)*; *au (ow, ou)*; *ao*; *ei*; *iu (u)*; *oi (oy)*.

Consonants: *k (c)*, *g*; *t, d*; *th, dh (dth)*; *ch (ty, tj, ts)*, *j (dy, ty)*; *r, r* Northumbrian), *l*; *y (i)*, *w*; *m*; *n*; *ng, n, nk, ngg*; *kw (qu)*. These are sounded as in English, *dh* being the *th* in 'the' and *ngg* the *ng* in 'finger.' The letters in brackets are often substituted. The guttural *ch* is said to be rare, but appears in Victoria and on the south-eastern border of South Australia. The guttural trill (Arab *ghain*, 'Melanesian *g*') seems to be described by Mathew as '*h* sharp, and clear like *r*.' The sibilants *s* and *z* are not found in the southern languages, but appear in the Cape York Peninsula and Mabuiag. The fricant *f* appears only in the Cape York languages; *v* also is rare. The aspirate '*h*' is apparently rare. Hartmann describes its sound in Victoria as equivalent to German *ch* in '*ich, mich.*' Taplin mentions '*h* sharp and clear' in Narrinyeri.

Combinations of Consonants. These are found in some of the languages—in Adelaide *rn, rl, dl, rt, nt, lt, rk;* in Kabi *br, pr, kr.* Such combinations are especially prominent in some of the northern languages, where we find such juxtapositions as *rr, rk, lk, rm, ly* (*y* consonant), *rb, ntr, fr, tr, rp, dp, tp, rk, lb, nb.*

Sound-changes. The sound-changes have not been properly studied. In some languages the surd and sonant consonants are said to be imperfectly differentiated; *k=g, t=d, p=b.* A few phonetic changes when particles are affixed have been noted in Wiradhuri, Narrinyeri, Adelaide and a few other languages. In this article no attempt has been made to rectify the vagaries of Australian spelling.

Grammar of the Southern Languages.—In morphology the Australian languages can hardly be said to fall within a single category. Though a large proportion of them are purely agglutinate, the assimilation of root and affix has brought others nearly to the inflectional stage. Thus in Wiradhuri we find that such suffixes as *-du* (genitive), *-di* (dative), are modified according to the terminal of the word to which they are affixed; e.g. *maddan-du* and *maddan-di* from *maddan,* wood; *balli-dyu* and *balli-dyi* from *balli,* boy; *inar-ru* and *inar-ri* from *inar,* woman. Friedrich Müller's statement that some Australian languages were at as low a stage as the formless languages of Further India (Burman or Siamese) was based only on imperfect examples of the south-western Australian dialects.

The nature of the root in Australian has not been thoroughly investigated. It appears to consist usually of one of two syllables. In forming words and in expressing their functions affixes are used, which themselves often consist of more than one syllable. In the southern languages suffixes are invariably used, in the northern prefixes, infixes, and suffixes. Reduplication does not appear to be a common feature. Expressing 'four' by a mere doubling of the word 'two' is the most common example. In Wiradhuri the reduplicated noun forms an adjective; in Kabi a partial repetition of a verb indicates intensity. Very few syntactical relations are expressed by position alone. The commonest are the position of the object before its verb, and the qualifying adjective after its noun.

Although in a sentence the distinction between noun and verb is quite clear, the facility with which nouns may be changed into verbs or adjectives, or verbs and adjectives into nouns, sometimes renders a rigid classification difficult. Thus in Narrinyeri (Encounter Bay) we have *tant-urmi* a bed, *tant-in* sleeping or to sleep; *pett-in* to steal, *pett-amalde* thief. The affix determines whether the word is noun or verb. Some languages distinguish persons from places and things, and employ different demonstratives or adjectives when used in apposition. Thus in Minyung *kumai* (large) is used to qualify animals and places; but with persons *kumaibin* is used for males, and *kumainagun* for females, while *kumainyon* or *kuminna* qualifies things. Some languages distinguish the feminine gender by a suffix; e.g. in Awabakal: *mulubinba-kal,* a male native of Newcastle, New South Wales; *mulubinba-kalleen,* a female ditto; in Wakka: *nyom* husband, *nyom-gun* wife. In Victoria: *amerjig* a white man, *amerjig-orok* a white woman.

Many languages distinguish the dual and plural of nouns by suffixes. In some the connection of the suffixes with the numeral 'two' and the adjectives 'few' or 'many' is plain; in others it is not apparent. Thus in Parnkalla: *yurralbelli* two men (*kalbelli* two), *yurru-rri* men (*kulbarri* three or several). Pittapitta: *kanari-pakoola,* two girls (*pakoola* two), *wungata-pityiri* women (*pityiri* is merely an affix).

The indication of the agent of a transitive verb by means of a suffix is very common, and in most of the languages the same affix denotes the instrument. Thus in Parnkalla: *Marralyi-nga ngai pittanarru kanya-nga,* boy me hit stone-with; Pittapitta: *yuppieri-lo kopena mali-lo kachea,* boy fish net-with catches. The genitive is commonly expressed by means of a suffix: Narrinyeri: *korn-ald menake,* man's beard; Kamilroi: *murri-gu burran,* man's boomerang.

In Pittapitta the genitive affixes vary according to whether the possessor and the possessed are persons or not; *koopakoopa-nga titi-wara,* old man's brother (*wara,* his), *koopakoopa-nga titi-wara-nga bibapooro,* old man's brother's boomerang; but *machoomba wapa,* kangaroo's pup, without suffixes. In many of the eastern languages this method appears to be common. The accusative generally appears without an affix, and is known by its position before the verb. Adelaide: *ngatto wodli taieta,* I house shall build. Wiradhuri: *mirri-du wille buddhe,* dog opossum bit. Most of the relations expressed in English by prepositions are indicated in Australian by nominal suffixes. These may not only show rest at, motion to and from, purpose, or origin, but express time, place, manner, direction, quantity and many other ideas. Some examples are:—

Parnkalla: *ngultapa-nga,* when he was a young man, *yara-lla,* as if he were a man, *mungkullutarri,* in the direction of the flagstaff. Wiradhuri: *Bidarai-bira-ndi,* from Bidarai's place. Narrinyeri: *tuni-watyeri,* full of sand. Pittapitta: *bibapooro-lo,* with a boomerang now, *moorra-ngo,* with a stick in the future.

Adjectives are often used as predicates, and are then conjugated as verbs. When used to qualify, they often take the same suffixes as the nouns to which they refer. Thus in Thurrawal: *nuggungai* I am good, *nuggumbi* thou art good, *nuggung* he is good, and so on in singular, dual and plural of all persons, tenses, and moods. In Kamilroi: *murri-du bura-lu burran-du kurrawile,* man big boomerang-with threw, *murri-gu bura-lu burran,* big man's boomerang, (*-gu, -lu,* genitive suffixes). As in the preceding example, the qualifying adjective usually follows the noun; but in some languages it precedes it.

Adjectives are often formed from the roots of other words by means of affixes. Thus in Kamilroi: *yul-arai* full, satisfied, *yul-ngin* hungry. Adelaide: *mai* food, *mai-tidli* provided with food, *mai-wadli* liberal with food, *mai-kudna* stingy. In some languages a kind of comparison is made by a suffix; more generally two positive statements are made. Parnkalla: *karra* high, *karralla* higher. Adelaide: *karru* high, *karra-intyerla* very high. Kamilroi: *murruba numma, nungurrage guggil,* good this, that (is) bad.

Words indicating place and direction are remarkable for their great variety, and it is to be regretted that they have not been more fully recorded. In the north-eastern and eastern languages they are often compounded with other words. Some Kamilroi examples are *ngowo* here, *ngurri* there in front, *ngutta* there on the right or down there, *ngurriba* there on the left or up there, *murra* there behind, *ngurribatai* from above. In Narrinyeri at least 30 words of this kind have been noted.

Australian pronouns usually distinguish the speaker, the person addressed and the person or thing spoken about. In the southern languages the inclusion or exclusion of the person addressed is indicated by the form of the first personal pronouns in the dual and plural. These may be distinct words, or the exclusion may be indicated by an affix to the inclusive form. Some examples of the first are:—Dieri: *ngaldra* you and I, *ngali* he and I (not you), *ngaiana* all of us, *ngaiani* we (not you). Of the second kind, Wiradhuri: *ngalli* you and I, *ngalliguna* he and I, *ngeani* we all, *ngeaniguna* we (not you).

In some languages the forms of the pronoun vary to indicate the relationship of the persons mentioned. Thus in Parnkalla, *ninna* is the ordinary pronoun 'thou,' but *nuro* means 'thou my father' or 'thou my child;' *ngadli* is 'we two' but *ngadlaga* means 'my mother and I;' *nuwalla* is 'you two,' but *nuwarinye* 'thou and thy son,' *pudlanbi* he and his wife. In Western Australia similar terms are very numerous. Some languages distinguish sex in the third personal pronoun. Thus Dieri: *nau* he, *nani* she. Minyung: *nguly* he, *nyan* she, *kully* he, she or it here, *mully* he, she or it there. Awabakal: *noa* he, *bountoa* she, (*bali,* we two) *bali-noa* he and I, *bali-bountoa* she and I. The third personal pronoun is often a demonstrative (this or that person or thing) and may thus indicate ideas of position. Some examples are:—Pittapitta: *nooie* he or it close in front or at the side, *nuaka* he or it or this close at the back, *nooari* he or it or that yonder. Awabakal: *ngali* he or this present, *ngala* that near, *ngaloa* that beside you.

In some languages the pronouns are said to express the verb 'to be,' and are inflected for tense or used as complete sentences. Pittapitta: *nŭjă,* I am or I was; *nŭnyō,* I will be. Awabakal: *ta,* it is; *tara,* they are.

In some of the Victorian languages the pronouns appear to consist of a noun with the possessive suffix, the noun-stem remaining in all persons and numbers. Thus in Woddowro:—

Bang-ik	I.	Bang-etuk-kollik	we three.
Bang-en	thou.	Bang-ud-kollik	you three.
Bang-nuk	he, she, it.	Bang-tana-kollik	they three.
Bang-ul	we two.	Bang-wodjok	we.
Bang-bullok	you two.	Bang-ud	you.
Bang-abulong	they two.	Bang-tanong	they.

The dual and trial of the pronouns often show traces of the numerals 'two' or 'three.' Thus *kollik,* in the Woddowro examples just given is the numeral three; and in Adelaide *purla* is they two, *purlaityе* two. Also Narrinyeri: *kengk* they two, *ninggengk* two. Kabi: *bula* two, and you two. Darkinyung: *bullabun* you two, *bulloara* they, *bulla* two. Western Australia: *boola* they two, but *goodjal* two.

The possessive pronouns are often formed from the same stem as the personal, and are sometimes identical with the genitive of the pronoun. The suffix used is generally different from that of the noun, and there is rarely any uniformity in the pronominal suffixes. The following table, in which the languages are arranged geographically from west to east, will give some indication of the variety in construction of the possessive pronoun:—

	I	my	thou	thy
W. Australia	nganya	nganalak	nginnee	nuncoluk
Parnkalla	ngai	ngaityе	ninna	nunko
Adelaide	ngali	ngaityo	ninna	ninko
Dieri	ngani	ngakani	jidni	jinkani
Narrinyeri	ngape	nganauwe	nginte	ngumauwe
Murundi	ngape	ngaiyo	ngurru	ngurrongo
Kamilroi	ngaia	ngai	nginda	nginnu
Wiradhuri	ngadhu	ngadyi	ngindu	nginnu
Woddowro	bangik	bangongik	bangen	bangongen
Darkinyung	ngaia	jannunggai	nginda	nginnunggai
Gundunggurra	goolangga	goolangooya	goolanjee	goolanyingoo
Thurrawal	ngaiagang	ngaiawooli	nyindigang	nyinduwuli
Awabakal	ngatoa, bang	enimoumba	ngintoa, bi	ngiroumba
Wakka	ngia	ngari	ngin	ngingori
Kabi	ngai	nganyunggai	ngin	nginyonggai
Pittapitta	nŭnjă	nŭnyătĭ	impă	ingkătĭ

The Victorian languages, some of the eastern languages and a few others also denote possession by means of a suffix.

	My boomerang	thy boomerang	his boomerang
Buandik	gettupgettup-main	gettupgettup-mun	gettupgettup-mung
Tyatyalla	gattimgattim-ek	gattimgattim-in	gattimgattim-uk
Thaguwurru	wangim-ik	wangim-in	wangim-o
Thurrawal	warrangan-dyen	warrangan-ngun	warrangan-hung

Pittapitta has different forms of the possessive, according to whether the possession is a person or thing: *Upperi* father, my father (no suffix), *pooti nunyati* firewood my, *titi mulla* brother thy, *bibapooro ingkati* boomerang thy. In all languages the pronouns are declined as nouns, often with the same suffixes. The distinction between the two forms of the nominative is as a rule only observed in the first and second persons singular of the pronoun.

Interrogative pronouns are analogous to the personal pronouns. There are usually words equivalent to 'What person? who?' and 'What thing?' For these expressions words based on

the syllables *ngan* and *mi* are very widely spread.

The verb is apparently rich in conjugational forms, but very few languages have been thoroughly investigated. The active verb is distinguished from the neuter, and each verb has various modifications to express reflective, reciprocal, continuative, causative or inchoative uses. These are usually distinguished by a change in the final affix, or by an auxiliary compounded with the principal verb. Some examples are:—Narrinyeri: *pingkin* to fall, *pinggen* to throw down, *nguldamul-mindin* to tire (compound of *nguldamulun* tires, and *mindin* to cause to be). Kamilroi: *ngummil* see, *ngummilmulle* to show (cause to see). Wakka: *buma* to strike, *bumjau* to strike another, *bumjinga* to kill (strike intensively). Parnkalla: *yabmirriti* to quarrel (*yabm-iti* to scold), *ngamma-ta* to run, *ngamma-ngutu* to cause to run, *ngammantutu* to continue running. In Wiradhuri there are a great many verbal formations of this kind, denoting various aspects of the action with regard to manner, time, place and accompanying circumstances. There are indications of similar constructions in other languages.

Moods and tenses are usually numerous, and are shown by suffixes to the stem. When followed by a suffix of number or person, these appear as infixes. Thus in Narrinyeri we have such forms as *lak* to spear, *laggelin* spearing, *laggelir* speared (participle), *lake* spear not, *lakilde* could spear, *lakkin* spear now, *lakkir* did spear, *lakemb* did spear long ago, *lakkani* will spear, *lakel* intend to spear, etc.

Except in the north-eastern and Victorian languages person is not indicated by the form of the verb. Many languages also use the same form for the singular, dual and plural, thus in south-western Australia: *nganya yening* I go, *bal yening* he goes, *ngela yening* we two go, *nō'ra yening* they go. Kamilroi: *ngai ngin-nuna ngummi* I you saw, *nginda ngunna ngummi* you me saw. But in Victoria person and number are indicated by the verb-ending. Thus in Tyatyalla: *takangul* we two (inclusive, i.e. you and I) beat; *takan* I beat; *takangulang* we two (exclusive, i.e. he and I) beat; *takar* thou beatest; *takawul* you two beat; *taka* he beats; *takabulang* they two beat; *takangukullik* we three (inclusive, i.e. you and I) beat; *takangu* we (inclusive) beat; *takandakullik* we three (exclusive) beat; *takandang* we (exclusive) beat; *takawa kullik* you three beat; *takawat* you beat; *takana kullik* they three beat; *takanaty* they beat. Similar forms are recorded in Gundunggurra, Thoorga, Thurrawal, and other languages of eastern New South Wales.

In other languages the change of suffix for person or number is only partial: in Darkinyung: *bondalittiwah* I eat, *bondalittiwi* thou eatest, *bondalittinoa* he eats, *bondalittinonda* she eats, but *ngullia bondalitti* you and I eat, *ngeang bondalitti* we eat—and so in other persons and numbers, which are only distinguished by the pronouns. In Parnkalla some numbers and persons of the verb are alike. Thus:—*ngai ngukata* I go; *ngadli ngukata* we two go; *ninna ngukata* thou goest; *nuwalla ngukamatta* you two go; *panna ngukatawo* he goes; *padlanbi ngukamatta* they two go; *ngarrinyelbo ngukata* we go; *nuralli ngukatanna* you go; *yardna ngukatanna* they go.

Simple and compound adverbs indicating time and place are very numerous. Many of them are plainly nouns with various affixes. The interrogative adverbs are formed usually from the interrogative pronoun 'What?'

Prepositions are not common, but appear in Victorian languages. Postpositions or affixed particles usually take their place. Certain names of positions are used in the Victorian languages with suffixed pronouns. Thus in Thaguwurru: *kallinudyik, kallinudyin, kallinudhu,* in front of me, thee, him; *wenyudyik, wenyudyin, wenyudhu,* behind me, thee, him. Sometimes the prepositional relation is included in the verb; Wiradhuri: *gulle* go up, *birrawa* go down.

The definite numerals are rarely expressed beyond 'two.' A few languages have a word for 'three,' but the usual expression is a compound of 'two' and 'one.' Examples of the numerals will be found in the notes on the several linguistic groups.

THE SOUTHERN LANGUAGES. In the notes which follow the order is mainly that of J. Mathew's classification, but for convenience' sake the subdivisions suggested by Schmidt have also been adopted.

1. *Victoria.* The largest linguistic group in Victoria was formed by the languages spoken in the north-west and central portions of the colony from the Goulburn and Broken Rivers in the north-east to the Wannon and Glenelg in the south-west, and from the Yarra in the south-east to Lake Hindmarsh in the north-west. A large number of tribal names have been recorded, many ending with the words *wurru* or *wurong,* or *tyalli* (meaning 'lip'), compounded with the word for 'no.' The following appear to be representative languages: (*a*) Burapa or Bureba (*burapper* no), in the north, from the Murray at Gunbower and Lake Boga to the lower Loddon at Boort; (*b*) Tyatyalla (Tatiara) and Buibatyalli in the north-west, from Lakes Werringen, Albacutya and Hindmarsh and the Wimmera River to Horsham; (*c*) Ngengenwurro, used on the upper Wannon and Glenelg above Sandford to the Tatiara country just over the border in South Australia; (*d*) Lewurru (*le,* no), on the Upper Loddon and Avoca Rivers from the Great Dividing Range to St. Arnaud, Mount Emu and the Wimmera at Glenorchy; (*e*) Thaguwurru (Thong-worong) in the north-east, along the middle Goulburn, westward to the Campaspe and eastward to the Ovens; (*f*) Wuddyawurru (Woddowrong, Witaoro) at Geelong, and on the western side of Port Phillip to Cape Otway and Ballarat; (*g*) Woiwurru (Wuiworong, Woeworong; *woe,* no), between the Hume Range and the lower Yarra as far as Melbourne; (*h*) Bunurong, in the south-east from Western Port to the upper Yarra at Healesville.

	one	two	ear	eye	hand	man
Bureba (Burapa)	kiarp	bullait	wimbuluk	minnuk	munnanuk	woitu
Tyatyalla	kaiup	bulaty	wurimbul	mirr	munya	wutyu
Ngengenwurro	kiarp	bullait	wimbuluk	minnuk	munnengnk	gole
Lewurru (Mt. Emu)	kiap	poolet	wirmbool	mir	munya	koolay
Thaguwurru	kôpthun	bulaubil	wirn	merin	mirnong	kulin
Witaoro	koenmoet	bullait	winguk	mirruk	munangin	koli
Woiwurru	kanbi	Lendyero	werring	merring	marnung	kulin
Bunurong	kop, koptun	polabel	werring	myring	munung	kulin

The Buandik (Bungandity) dialects were spoken in the south-west of Victoria from Lake Corangamite across the basin of Mount Emu Creek and the Hopkins, Eumeralla and lower Glenelg Rivers to Rivoli Bay and Mount Gambier in South Australia. They appear in three groups: (*a*) Buandik, at Mount Gambier and between Sandford and Dartmoor on the lower Glenelg. The Nundatyalli on the north towards Horsham apparently connects with the West Victorian; (*b*) Wanikin, at Mount Rouse and the Crawford, Wannon and upper Glenelg Rivers; (*c*) Dautgart: Hopkins and Eumeralla Rivers and Lake Condah.

	one	*two*	*ear*	*eye*	*hand*	*man*
Buandik	wondo	bolite	wrung	mir	murna	drual
Bungandity	wandho	boaity	wah	mir	murra	drual
Wanikin	kiup	polite	weerring	moeing	murrung	koloin, marah
Dautgart	koimoil	bulad	wing	ming	murrung	marra

Kolijon was a small tribe east of Lakes Colac and Corangamite. A few grammar forms and a short vocabulary show some likeness to the Buandik.

The Piangil dialects apparently connect the Burapa of western Victoria with the Wiradhuri of New South Wales. They are found under the tribal names of Wottiwotti (*wotti* no) at Swan Hill and Tyntynder, and Laitchilaitchi (*laitchi* no) at the junction of the Murray and Murrumbidgee.

	one	*two*	*ear*	*eye*	*hand*	*man*
L. Colac	—	buladduk	weinyeduc	mrinyeduc	macnyinuc	mondel
Kolijon	—	bulad	weregnennok	mirgnennok	mangennok	tharoong
Wottiwotti	kyup, yoori	pola	wirmpool	mirnoo	murnagna	woortongi
Laitchilaitchi	geyabi	boolagi	wimboola	mingi	munnagi	wooni

The south-eastern corner of Victoria from Anderson's Inlet to Cape Howe was the home of the Kurnai (*kurnai*, *kani* man). Five tribes are named by Howitt: Bra-tanolung (*bra* man), Bra-inkolang, Bra-brolung, Tatungolung, and Kroatungolung. Curr thought that there were 'probably six or seven distinct languages,' but only one, the Brabrolung (Brabirrawulung), is recorded. A different language appears in the east at Omeo. Specimens from Lake Tyers by Bulmer and from Lake Wellington by Hagenauer in Curr appear mixed with West Victorian. R. H. Mathews has a grammar of Brabirrawulung.

	one	*two*	*ear*	*eye*	*hand*	*man*
L. Tyers	kootopan	boolooman	wring	mre, mri	bret	brah, kanni
L. Wellington	—	—	wring	mooeh	pritt	kanny
Gippsland (Hagenauer)	kiap	boolet	wooring	toorooming	manya	garny
Brabirrawulung	gutuban	bulaman	wring	mirri	brety	kunnai, bra
Gippsland (Howitt)	gootup	bullum	ooeng bunnumgurry	mree	prett narrungnung	kurni

2. *Narrinyeri.* The Narrinyeri is one of the better known languages of South Australia. It was spoken by the tribes living on Encounter Bay, the eastern side of Lake Alexandrina and the Lower Murray. There are good grammars and vocabularies by Meyer and Taplin. The vocabulary is distinct.

3. *The Lower Murray.* The languages along the lower Murray present a progressive divergence in grammar from Narrinyeri, with great differences in the vocabulary. The following names appear:—(*a*) Murundi, on the lower Murray from Wellington nearly to the North-west Bend; (*b*) at the North-west Bend a distinct language is found; (*c*) Kemendok, the language of the Yerreyerre tribe about Mildura; (*d*) Yittha, about the junction of the Lachlan and Murrumbidgee. The Murundi is represented by a grammar. It shows some resemblance to Narrinyeri, but the affixes usually differ.

4. *The Upper Murray.* The basin of the upper Murray and its tributaries was apparently occupied by tribes whose languages, though distantly related, differed very greatly in vocabulary from those north and south of them. These languages were the following: (*a*) Dhudhuroa, in the basins of the Mittamitta and Kiewa Rivers as far as the Murray between Albury and Jingellic; (*b*) Emu-mudjug, about Barnawatha, west of Albury; (*c*) Bangerang, from Deniliquin southward to Echuca and the basin of the Goulburn. Curr gives the Toolinyagan as one of the Bangerang tribes, and R. H. Mathews calls them Yotayota; (*d*) Ngarrimowro, north and south of the Murray at Yulima. This is said to be related to Bangerang; (*e*) Pallanganmiddah, west of the Kiewa River and south of Emu-mudjug. The grammar of these is known only from short notes.

	one	*two*	*ear*	*eye*	*hand*	*man*
Narrinyeri	yammalaitye	ninggengk	plombi	pili	mari, turne	korni
Murundi	metattu	tangkul	mario	korllo	mannuruko	meru
N.W. Bend	mata	rankool	marwarl	meeyee	koolpo	maree
Kemendok	meta	raangool	mur	mi	wain	ngult
Yittha	mo	thral	maorl	laong, laank	waing	nunna
Dhudhuroa	kurdawunga	buladherabo	murlamboa	wundyaba	murra	dyaba
Emu-mudjug	—	—	mutha	mill	murrah	mung
Bangerang	iawa, ioong	boltubol	marmoo	meul	beyin	enbenna
Toolinyagan	iawa	boltubol	—	meul	—	yeyir
Yotayota	iawa	bultyobal	marmu	me	tyirtyirran	yiyir
Ngarrimowro	warrangan	platir	maram	ma, mawo	pirik	bawo
Pallanganmiddah	—	—	mirimbah	mee	murrah	gerree

5. *The Wiradhuri and Kamilroi.* A group of allied languages, of which the Wiradhuri and the Kamilroi are the best-known, occupy a very large area in central and southern New South Wales. They extend westwards from the Blue Mountains and New England beyond the Bogan and Lachlan, and thus occupy the basins of the Lachlan, Murrumbidgee, Bogan, Castlereagh,

Namoi, Gwydir and Dumaresq rivers, and of the Moonie and Culgoa, north of the Barwon. The main divisions are: (*a*) Wiradhuri (Wirajuri, etc.), in the south-east, from the Murray about Deniliquin and Albury across the Murrumbidgee to the upper Bogan, Macquarie and Castlereagh; (*b*) Wongaibon, on the middle Lachlan and northwards to the Bogan; (*c*) Wailwun, in the north, along the Barwon valley from Brewarrina to Walgett and southwards about the lower Castlereagh and Mara; (*d*) Ngeumba, on the lower Bogan; (*e*) Burrabinya, on the Bokhara and Culgoa, north of the Barwon; (*f*) Kamilroi, in the north-east from Walgett over the Liverpool Range southwards to the Goulburn and Upper Hunter, including the basins of the Namoi (Liverpool Plains) and Gwydir; (*g*) Yualeai (Euahlayi, Yowalleri), Nguri and Wirriwirri in the north, from Bourke and Walgett across the Barwon, Bokhara and Culgoa into the basins of the Moonie and Weir in southern Queensland. With the exception of the Nguri and Wirriwirri, all these languages are well illustrated by grammars and grammatical notes.

	one	*two*	*ear*	*eye*	*hand*	*man*
Wiradhuri	ngunbai	bula	uda	mil	marra	gibber, main
Wongaibon	mukku	bulagar	woodtha	mil	murra	thurgala
Wailwun	muggu	bulagar	kuringgera	mil	murra	tabur
Ngeumba	mukku	bulagar	wuttha	mil	murra	mali
Burrabinya	muggu	bulagar	—	—	—	bullu
Kamilroi	mâl	bûlar	binna	mil	murra	giwir, murri
Yualeai	millan	bullar	udha	mil	ma	urē
Nguri	—	—	pinna	mil	ma	iure
Wirriwirri	—	—	pinna	meel	myya	—

6. *Coast Languages of New South Wales.* In eastern New South Wales the distribution of the languages is determined by the ranges parallel to the coast. There are two well-marked sections, one in the north, the other in the south, for which Schmidt proposes the names *Kuri* and *Yuin*, from the words for 'man' common to each group.

The following languages represent the northern group (Kuri):—(*a*) Bripi, at Port Macquarie and on the Hastings and Wilson; (*b*) Kutthung, on the coast near Port Stephens; (*c*) Awabakal, at Newcastle and Lake Macquarie; (*d*) Wanarua, from Maitland to the Liverpool Range; (*e*) Darkinyung, on the Hawkesbury and Broken Bay, and inland to the Hunter; (*f*) Dharruk and Gundunggurra, from the mouth of the Hawkesbury to Mount Victoria and south to Berrima and Goulburn (Dharruk on the coast, Gundunggurra inland); (*g*) the Port Jackson language. The Awabakal was the subject of the first Australian grammar by Threlkeld, who also published many illustrations of its structure. R. H. Mathews has published notes on Darkinyung, Dharruk, and Gundunggurra.

	one	*two*	*ear*	*eye*	*hand*	*man*
Bripi	warkol	blarvo	moko	mee	mar, yammar	koori, korry
Kut'thung	wokkool	bullora	nurrean	mikkong	mut'era	kooree
Awabakal	wakal	bula, buloara	ngureung	ngalkung	matara	kore
Wanarua	munmaan	bulnara	pinna	mekong	mater	kurri
Darkinyung	wakul	bulla	binungari	mikkang	birril	kuri
Dharruk	wagulwai	buler	kuri	mibberai	dhummar	dhullai
Gundunggurra	meddung	bulalli	—	—	—	(murrin) (bowwil)
Port Jackson	wogul	boola, yublowre	gorai	mi	tamira	mulla, cora

The following languages appear to represent the southern group (Yuin):—(*a*) Thurrawal (Turruwul), from Port Hacking and Botany Bay to Jervis Bay, including the Wodiwodi about Wollongong and Illawarra; (*b*) Tharumba (Muruya), about the Shoalhaven River, north of Jervis Bay; (*c*) Ngunawai, inland from Goulburn and south-west to Yass and Lake George; (*d*) Thurga, on the coast south of Jervis Bay as far as Bermagui; (*e*) Dyirringan, south of Thurga to the Victorian border; (*f*) Ngarrugu (Ngarago), inland to the Monaro district and from Omeo to Queanbeyan. All these languages have been the subject of short notes by R. H. Mathews.

	one	*two*	*ear*	*eye*	*hand*	*man*
Thurawal	middhung	bullar	guri	meh	murramul	yuin
Tharumba (Muruya)	—	—	(guri)	(mabara)	(māna)	(yuen)
Ngunawai	meddhung	bullāla	guri	migalaity	murrangga	murriñ
Thurga	mirdindhal	jirreeba	koorree	mabora	murna	yooin
Dyirringan	mirdindhal	dyirriba	—	—	—	baūl
Ngarrugu	bur, burē	bulala	dyanyange	gundthul	murrungga	baual

7. *The Eastern Languages.* A number of very slightly connected languages are spoken in the east of New South Wales and Queensland, between the mountains and the coast. The following are the main groups in New South Wales, beginning from the south:—(*a*) Thangatti, spoken on the lower Macleay north of Bripi; (*b*) Kumbainggeri, on the coast from Nambucca to Grafton and the Clarence; (*c*) Yukumbul (Yookumbil, Yukomble), in New England about Glen Innes and Tenterfield, and inland from Minyung; (*d*) Minyung, on the Richmond and Tweed Rivers. Three dialects are named: (1) Nyung on the Richmond, upper Clarence and Tweed; (2) Ngando on the Tweed and at Point Danger; (3) Northern, on Darling Downs and along the Albert; (*e*) Pikumbul (Begumble, Bigambel), at the junction of the Macintyre and Dumaresq, and on the Weir (on the border of Queensland and New South Wales); (*f*) Murrawarri. This language, spoken far inland between the Culgoa and Warrego Rivers, is assigned by Schmidt to this group.

	one	*two*	*ear*	*eye*	*hand*	*man*
Thangatti	wadhu	butabuta	binnagum	mi	yamma	guri
Kumbainggeri	guragun	bulari	ngaigan	mil	mara	nigar
Yukumbul	dharrar	boota	ema	mil	yama	gibber
Minyung—						
Nyung	yabra	booroora	binung	me	tongun	baygul
Ngando	yaburu	bula, bula	binnung	mia	tungen	paigal, mibbin
Northern	yaburu	boolaroo	benung	me	kungal	bigul
Pikumbul	dharrar	buta	bidna	mil	mara	mial
Murrawarri	yaman	kubbo	binna	mil	murra	main

MEDICINE MAN EXTRACTING EVIL MAGIC (NORTHERN TERRITORY)

GROUND DRAWING CONNECTED WITH A SNAKE TOTEM (NORTHERN TERRITORY)

PREPARING FOR A CORROBOREE (CENTRAL AUSTRALIA)

The main groups in Queensland, beginning from the south, are:—(*a*) Turrubul, at Moreton Bay and along the Brisbane River. Somewhat doubtfully related to this is the Guwar language of the Wogee tribe on Moreton Island, and the Jandai language of the Goenpul tribe in the centre and south of Stradbroke Island. The Jagara language of Lauterer also seems related; (*b*) Kabi dialects, spoken over the Burnett and Wide Bay districts, and on the coast and islands from Bustard Bay to the north side of Moreton. There are numerous dialects. J. Mathew gives a grammar from Mary River, and Ridley notes on the Dippil of Moreton Bay; (*c*) Wakka dialects, used about the Great Dividing Range along the upper waters of the Dawson and Condamine. There are several dialects. J. Mathew gives a grammar of the language about the upper Brisbane. The Merooni, used at Bustard Bay, is similar; (*d*) Bieli, an imperfectly known but distinct language, used on the coast from Keppel Bay to Port Curtis, and inland to Calliope; (*e*) The Broad Sound, Marlborough, Rockhampton and Yaamba language appears in this group; (*f*) The tribes at Halifax Bay, on Palm, Hinchinbrook and Cardwell islands, and on the upper Herbert, are said to speak one language. Curr enumerates several tribes with names ending in *bara* or *burra*. Cleveland Bay specimens show a different dialect.

	one	*two*	*ear*	*eye*	*hand*	*man*
Turrubul	kunnar	budela	pidna	mil, mia	murra	dan, tyan
Guwar	kurraboo	boodla	pinnung	mee	kining	mugee
Jandai	kunara	boodla	pidna	mel	murra	malar
Jagara	kanyara	bullae	binne	mil	mara	gocranam
Kabi—						
Mary R.	kalim	bulla	pinang	mi	piri	dhan
Up. Burnett	noola, noolang	boolla	binna	meel	peeroo, birroo	dthan, marree
Merooni	karlim	boolla	bidna	meel	gillee	daan
Dippil	kalim	bular	binung	mi	duruin, dukkur	dan
Wakka—	kabuin	boiyo	pinang	ma	na	muran
Dawson R.	kumbe	booa	bina	meay	na	mean
Up. Brisbane R	karro	booyoo, yerlo	pinnung	mia	bay, bee	dthun
Bieli	webben	booli	bidna	mill	mooloom	kingkel
Broad Sound and Rockhampton	onegan, werpa	blaue, bullari	binn, pinna	mill, meel	nelli, lily	kattar
Halifax Bay	yongole	yakka	binna	koro	mandy	tinga
Cleveland Bay	yoengul	yugga	pinna	mael	malla	goongarre

8. *Central Queensland.* A number of related languages are found in central Queensland in the region between the upper waters of the Thomson, Barcoo, Paroo, Warrego and Maranoa on the south, and those of the Diamantina and Burdekin and the Cook district on the north. Languages representative of the western group are:—(*a*) Kungeri. This includes the Kungeri on the upper Thomson and Barcoo; the Kungarditchi, east of the Thomson; and the Birria, west of the Thomson below Jundah; (*b*) Kogai or Kogurre, from the upper Paroo and Warrego eastward; (*c*) Barcoo. From the Barcoo to Tambo on the Nogoa the dialects fall into two not very distinct divisions. One is represented by the Yangeeberra on the Barcoo, the other by the Bimurraburra on the Nogoa River. Barcoo and Kogai are connected with Goa by a mixed language used about the Alice and Mount Enniskillen; (*d*) Goa, on the upper Diamantina and Hamilton, and on Middleton Creek; (*e*) Puruga, from Cornish Creek on the upper Thomson north-west to the upper Flinders and north-east to Cape River; (*f*) the Cook district languages continue the Puruga northward to the Walsh and Gilbert, and to the northern languages.

The eastern group may be represented by:—(*a*) Briaba, the language about the upper Burdekin and Clerke and southward to Bowen Downs. Oriba Kulba, at Mount Black, is different; (*b*) Eneby. This is said to be the language of a number of tribes in the basin of the Cape River, on Porter's Range, and about Charters Towers and Natal Downs. Many of the tribal names end in 'burra:' Pegullo-burra, Yucka-burra, Wokul-burra, Koombokka-burra; (*c*) Yuipera (Port Mackay Group). East of the Eneby-speaking district a number of tribes with names ending in 'burra' appear to have reached the coast. Their district lies along the Mackenzie and Isaacs rivers, northward to Fort Cooper (Nebo), Mackay and Port Denison. The Nebo tribe is known as Aminungo.

	one	*two*	*ear*	*eye*	*hand*	*man*
Kungeri	murina	barcoola	munga	meyel	murra	karkoora
Kungarditchi	matina, ungal	barcoola	munga	meyel	murra	carcoora
Birria	mirina	barkooloo	kurra	me-il	marra	mirti
Kogai	wongarra	boolardo	munga	tilli	murda	murdie
Yangeeberra	wongarra	muta	ammga	dilli	murra	murri
Bimurraburra	wungarra	boolaroo	manga	dilli	marra	mardi
Alice River	wongara	booladie	munger	tillee	murra	cubbee
Goa	kooronyō	oora	munga	tilli	murra	kando
Puruga	ungarr	boolarri	munga	dthilli	murra	murree
Head of Walsh R.	werrba	boolerry	munga	dilly	mulla	bamma, moorka
Briaba	wirba	boollaroo	wolloo	tillee	mulla	murri
Oriba Kulba	anga	poolari	arlo	telle	murra	ngoomba
Eneby	wigin	poolaroo	walloe	dthille	malla	murree
Koombokka-burra	whychen	bullaroo	wolloo	dilley	malla	meean
Yuipera	warpur, watchin	boolera	walloo	tilly, dilly	mulla	murry, bomma
Aminungo	wurba	piurro	wollo	tille	mulla	murri

9. *West Australian.* Only one language appears to have been spoken in that portion of Australia which lies south-west of a line drawn from the west coast near Mount Peron to the south coast at Esperance Bay. The numerous vocabularies show very little difference between dialects. The grammar is fairly well-known, and a few texts have been published.

	one	*two*	*ear*	*eye*	*hand*	*man*
Swan River	gen	kujal	tonka	mĕl	mara	yungar, mammarap
Pinjarra	dūmbart	gugal	dwanka	mail	murra	nungar
Newcastle	kain	guchal	dwanga	meal	mara	yunger, mamerup

10. *West Central Australian.* A chain of connected languages stretches across western Australia in a diagonal direction from the north-western and western coasts between the De Grey and Swan rivers to the southern coast between Cape Pasley and Streaky Bay. The representative languages appear to be:—(*a*) Ngurla (De Grey River), Widukari (Shaw River), the language used at Nickol Bay, and Kakarakala (North-west Cape), all on the west coast; (*b*) Majanna (Shark Bay), Eaw (Northampton), and that used at Champion Bay on the west coast; (*c*) Muliara (upper Sandford), Natingero (200 miles north-east of Newcastle), and the dialects of the Gascoyne and the upper Murchison; (*d*) Mining (inland from West Australian, in the Fraser Range and on the south coast between Point Culver and Eucla); (*e*) at Streaky Bay and Marachowie the language appears mixed with Parnkalla.

11. *Luritcha.* The Luritcha (Loritja, Aluridya) is spoken on the borders of Western and South Australia and in the Everard and Musgrave Ranges, as well as in the Blyth Range and about Lake Amadeus. The people are in contact with the Aranda, but differ entirely in language. No grammar is published, but abundant material has been provided by Strehlow. As in Aranda, a peculiar speech is used in mystic ceremonies.

	one	*two*	*ear*	*eye*	*hand*	*man*
Ngurla	purdinal, purda	kootera	weening, koolka	cheedamurra	mara	ngurda
Widukari	ekkamurda	kootera	weening	toola	mara	ngaiada
Nickol Bay	koonjeree	kootara	koerulka, koolga	toola	mara	nuncaberree
Kakarakala	kootea	kootthurra	worlingba	kooroo	mindie	kardoo
Majanna	kootea	koodthera	gulga	gurra	mara	karoo
Eaw	koothea	woother	wolker	mealo	marra	hanman
Muliara	koodia	koothera	koolga	kooro	mara	yamajee
Natingero	kain, kuddee	koogal, koodthera	kulkar	kurroo	marra	youngal
Gascoyne R.	—	—	goolga	coora	marra	yamagie
Up. Murchison	kutia	kutharra	kulka	kuru	murra	yammaji
Fraser Ra.	kaiaddnu	kutharra	guia	meyl, wardoo	murra	minninng
Eucla	kyunoo	koodal	goolaya	wordoo	marra	meening
Streaky Bay	kooma	koothera	yooree	meena, meil	murra	kurda, niunga
Luritcha—						
Ordinary	kutu	kutara	pinna	kuru	mara	patu
Mystic	kunu	kunara	arinbiri	lalilba	mulkuti	urati

12. *South Central Australian.* The languages of South Australia south of Lake Eyre form two groups, one north, the other south of Lake Torrens. In the northern group several apparently distinct languages are found, of which the following are representative:—(*a*) Wangarabunna, spoken around the western, northern and southern shores of Lake Eyre; (*b*) Dieri, from Lake Eyre eastward along Cooper's Creek. The language used on the Warburton (Ominee) is similar. We have two Dieri grammars and a translation of the New Testament into Dieri; (*c*) Yarrawurka (Yowerawoolka, Yandrawandra), on Cooper's Creek, Coony Lake and Mulligan River; (*d*) Pono (Evelyn Creek), and Mulyanapa, in the north-west corner of New South Wales; (*e*) Wonkamarra, on the lower Bulloo River in south-west Queensland.

Of these languages Dieri and Pono show a connection with the languages of west central Queensland, and Wonkamarra with the eastern languages.

	one	*two*	*ear*	*eye*	*hand*	*man*
Wangarabunna	muyu	parculu	yarri	milyardi	murra	nulla
West of L. Eyre	oyoo	parakula	yerri	miltekurte	murra	nulla
Dieri	kulno	mandru	talpa	milki	mara	kana
Ominee	koono	mandroo	talpa	milkee	murra	kanna
Yarrawurka	koorno	parakoola	koochara	mitchie	murra	kerna
Pono	koola	mundera	kutchera	mirlke	murra	kurna
Mulyanapa	koola	boola	waimerta	milpa	murra	yarlye-oorra
Wonkamarra	tharranya, warra	barcōōla	bina, pinna	mongura	murra	ura, ngoora

The languages used round Spencer Gulf appear to form three related sections:—(*a*) Parnkalla, at Port Lincoln, on the western shore of Spencer Gulf and generally throughout Eyre Peninsula, south-east from Streaky Bay and the Gawler Ranges; (*b*) Tura, north of Spencer Gulf and east of Lake Torrens. This language appears under several tribal names—Arkabatura (70 miles north of Port Augusta), Kooyiannie and Unyamootha (Beltana), Kortabina (east shore of Lake Torrens), Tura or Eura (Mount Serle), Nimbalda (Mount Freeling)—and connects Parnkalla with Meyu; (*c*) Meyu, on the eastern shore of Spencer Gulf, Yorke Peninsula and the Adelaide district.

	one	*two*	*ear*	*eye*	*hand*	*man*
Parnkalla	kubmanna	kalbelli	yurre	mena	marra	yura
Gawler Range	goo-o-mana	kilbelly	euri	meena	murra	ura
Arkaba-tura	oobmana	alpilya	urie	mena	mura	tura
Kooyiannie	coobmana	mundru	euri	mena	murra	thura
Unyamootha	oomerta	yierlina	yoorie	minna	murra	yoora
Kortabina	koopmana	kylepela	urie	mena	—	tura
Tura	obmooto	idtpillina	eure	mina	murra	eura
Nimbalda	unaworta	alpillana	yurie	minna	murra	mirru
Adelaide	kuma	purlaitye	yurre	mena	mara	meyu
Yorke Peninsula	ariekoo	bulli	daltie	minna	mirra	nipoo

13. *East Central Australian.* In this division the Darling languages may be distinguished from those of western Queensland. A number of closely associated languages are spoken over a wide extent of country in the valleys of the Darling, lower Paroo and Warrego, and towards the Barrier Range, where they connect with Parnkalla and Yarrawurka. The following names appear:—(*a*) Marowra on the lower Darling, north-west from Menindee and Wilcannia; Milya-uppa on Torrowotto Lake, and Parooinge on the lower Paroo, appear to speak the same language; (*b*) Kurnu, on the Darling from between Tilpa and Louth northwards to

Bourke, and on the lower Warrego; (*c*) Bahkunji (Bahkinji). A vocabulary under this name in Curr shows the same language as Kurnu; but Cameron gives a list in Bahkinji (along the Darling to Menindee) which shows relationship to Kungĕri on the South Australia-Queensland border; (*d*) Baddyeri, from Yantabulla to Hungerford and Thargomindah.

	one	*two*	*ear*	*eye*	*hand*	*man*
Marowra	ngitcha	bulla	uree	maykee	mera	maalee
Milya-uppa	neecha	barcoolo	ure	mee-ee	murra	wimbiga
Parooinge	itcha	barkoola	uri	mikki	murra	marli, wimbitcha
Kurnu	—	pakulu	yuri	mainmurra	murra	wimbadya
Bahkunji (Curr)	nēēcha	bōōlla	eūrrĕe	mĕĕky	mūrrá	wimbājā
Bahkinji	—	—	munga	miiki	murra	wa-imbi
Keramin	—	—	mung	mi	g'wan	narik
Baddyeri	kurritya	bulunna	yuri	mainyu	marra	kurna

A number of related languages are spoken in western Queensland from Middleton Creek (on the upper Diamantina) across the Hamilton and Georgina junction to the Mulligan. The following are representative:—(*a*) Pittapitta, on the Burke, Hamilton and Georgina rivers (this appears under various names in Roth and Curr); (*b*) Ulaolinya, west of Pittapitta on the upper Mulligan; (*c*) Wonkajera, north of Ulaolinya; (d) Miorli (Myallee), on the upper Diamantina; (*e*) Karawalla, on the lower Diamantina.

Pittapitta has been studied by Roth. It shows several peculiarities of grammar, especially in the pronouns, which indicate gender, locality and time, as well as case, and singular, dual and plural number.

	one	*two*	*ear*	*eye*	*hand*	*man*
Pittapitta	oorooroo	pakoola	nara	mē	murra	kana
Ringaringaroo	ngooroo	barcoola	ngarrowa	mer, milardy	murra	kerna
Karanya	oorooroo	pakoola	nara	mē	mooroo	kāna
Ulaolinya	goonyala	pakooloo	narawidula	naka	murra	wolpella
Wonkajera	goonyala	pakooloo	narawa	meladi	murra	kana
Miorli	oorooroo	pakoola	nara	unga	murra	kana
Karawalla	orroo	barkoola	nuri	miiki	murra	kerna

14. *North-west Queensland.* A great many vocabularies have been collected in the region (between the Great Dividing Range and the Gulf of Carpentaria) which includes the basins of the Leichhardt, Cloncurry and Flinders. In the absence of grammar notes, the dialects are difficult to classify. The representative languages appear to show four sections:—(*a*) Wunamurra (Oonamurra), on the upper Flinders and Saxby; (*b*) Mitakudi, on the Cloncurry; (*c*) Miape and Mikulon, between the Cloncurry and Leichhardt; (*d*) Mikadūn, on the Leichhardt.

	one	*two*	*ear*	*eye*	*hand*	*man*
Wunamurra	čner	koorto	bina	mĕl	mūlla	agūr
Mitakudi	pekoondul	koorto	pina	uko	mūmbela	agūr, pūnyīl
Miape	ingomar	blagura	binnare	mille	mullero	bungil
Mikulon	deinba, moar	blakara	benarr	mille	mambilla	eerman
Mikadūn	wongarri	kurbayla	binna	tibarri	malla	yirrman

The Northern Languages. The justification for separating the northern languages of Australia from those of the south consist mainly in (*a*) the great variations in vocabulary, which indicate independent languages, (*b*) the use, in the west and centre of northern Australia, of grammatical methods entirely foreign to the southern languages e.g. prefixes and infixes, and (*c*) the absence in many northern languages of the distinction between the inclusive and exclusive personal pronouns. Schmidt's classification has been already mentioned, but in what follows a geographical arrangement is adopted. A few notes on grammar are added, when this differs from that of the southern languages. Five regions may be distinguished: (1) Cape York Peninsula; (2) Carpentaria; (3) Aranda; (4) Northern Territory; (5) North-western Australia.

1. *Cape York Peninsula.* The languages of Cape York Peninsula do not diverge very widely from the southern languages in grammar, but differ so much from them in details and in vocabulary, that it is expedient to class them (at least provisionally) as a distinct division. In the south of the peninsula some mixture with southern languages is evident. The following language-groups appear: (*a*) Mabuiag, on the western islands of Torres Straits (the speakers of this language are physically Papuans, and the northern island, Saibai, is close to New Guinea); (*b*) The Cape York group, comprising Yaraikāna, on the western side of the Cape; Ngerrikudi, on the Batavia, Mapoon and Coen Rivers; Gudang, on the eastern side of the Cape; and Otati, at Cape Grenville; (*c*) Weymouth Bay; (*d*) Princess Charlotte Bay; (*e*) Koko-yimidir and Bulpoonara, from Weary Bay and Endeavour River to Cape Flattery, and probably inland to Granite Range and Bloomfield Valley; (*f*) Mirkin, on the Palmer River, and Koogoominny, on the Mitchell River; (*g*) Queeariburra, on the Lynd River; (*h*) Walsh River; (*i*) Mount Elliot, Cape Cleveland, and the mouth of the Burdekin.

	one	*two*	*ear*	*eye*	*hand*	*man*
Mabuiag	urapun	ukasar	kaura	dan	get	mabaeg
Yaraikana	ipima	orima	ewoi	annga	mata	ama
Ngerrikudi	pema	ambute	woa	adae	a	ma
Gudang	pirman	ilabiu	iwunia	ratair	ata	imbamoyu
Otati	wema	aroma	ewoi	yciti	ara	baiala
P. Charlotte Bay	—	—	yimpa	toontree	boolom	—
Koko-yimidir	nobun	godera	milka	mil	mangal	bama
Bulpunarra	nobin	mummera	mitkabuggir	meil	murra	bumma
Granite Range	nupun	mumurra	binna	mee-i	murra	pumma
Bloomfield Valley	nupoon	marmara	milger	mil	mara	dingar
Mirkin	appool	impa	innur	immun	irre	immi
Koogoominny	apul	yirnpa	enar	emun	—	parma, jimmi
Queeariburra	nyana	nuyuona	—	—	—	murri, mali
Walsh River	gatim	bul	wi	lipwar	dhi	lunjin
Mount Elliot	woggin	boolray	deeragun	teeburra	kabankaban	munya
Mouth of Burdekin	warrin	blarin	kungun	deebara	wurrumby	dulgooh

The grammars of Mabuiag, Yaraikana, Ngerrikudi, and Koko-yimidir are fairly well-known, but none of them shows any wide divergence in type from the southern languages. Those in the north distinguish the inclusive and exclusive pronouns. In Mabuiag the verbal root has an indefinite signification, which is rendered definite by a prefix. Thus *palai*, separate, cut into, split; *adaka-palai*, to let out (*adaka*, to the outside); *dan-palai*, live, open eyes (*dan*, eye); *minar-palai* write (*minar*, mark); *poi-palai*, shake off dust (*poi*, dust).

2. *Carpentaria.* South of the Gulf of Carpentaria several languages are recorded, with entirely distinct vocabularies and unknown grammar. These are (*a*) Karrandee, on the Gulf of Carpentaria, from the Bynoe River to the Norman and inland; (*b*) Wollongurmee, from the mouth of the Norman to the hills below Cambridge Creek; (*c*) Yangarella, on the eastern side of the Nicholson, to the coast; (*d*) Mingin (Minkin), at Burketown and west of the Leichhardt; (*e*) Leeanuwa, on the McArthur at Borroloola; (*f*) Kalkadoon, on the Barkly Tableland and Selwyn Range; (*g*) Walookera (Elukera), on the upper Georgina from Roxburgh to Carondotta; (*h*) Yanda, at the head of the Hamilton; (*i*) Yelina, on the Burke.

	one	*two*	*ear*	*eye*	*hand*	*man*
Karrandee	lum	bugar	nulliak	ale	maar	aam, ngaan
Wollongurmee	orter	gaulloor	womellar	eller	orunnoor	arpmoor
Yangarella	chadra	chiarnga	maralda	miboolda	malda	choigno, wompoora
Mingin	choarngngo, tualno	tigina, digana	mara, murra	migilla, midialla	nangara, nungurra	wompoora, nurka
Leeanuwa	yarkula	kinemada	narnlina	wane-mie	ana-malide	narminingia
Kalkadoon	ïër	iïadi, moodooma	inta, yintha	milti, milthe	makati	uro, yerro, mido
Walookera	argoloo	kotya	mūnkaro	mūnga	murkana	karo
Yanda	gooniba	boolari	talgan	meal	murra	warriki
Yelina	mooreroo	cherkumber	eneri	milla	wanera	eri

3. *Aranda.* Aranda and its dialects are spoken over a considerable area in central Australia, from the Georgina in western Queensland westward to the Macdonnell Range, the Finke, and the Peak in South Australia. The main divisions are:—(*a*) Yaroinga, in the north-east on the upper Georgina from Lake Nash to Gordon Creek; (*b*) Undekerebina, in the Toko Ranges; (*c*) Plenty and Marshall rivers in the north-east; (*d*) Aranda, in the west in the Macdonnell Ranges, on the Finke, and at Charlotte Waters and Alice Springs; (*e*) Wychinga, in the south-west on the Macumba.

The grammar is of a type similar to South Australian, but the pronouns, particles and vocabulary are absolutely distinct. The pronouns will serve as examples:—Common, singular: (1) *ata, ja, jinga;* (2) *unta, nga;* (3) *era, nala.* Mystic, singular: (1) *anua;* (2) *rankaltya;* (3) *allya.*

	one	*two*	*ear*	*eye*	*hand*	*man*
Yaroinga	âwoonyĕrā	ŭttĕrā	elpă	ŭngă	eljă	ŭrtwa
Undekerebina	âwŏnyĕrā	ŭttĕrā	yālbă	ŭlknă	yĕlkă	ŭppreellă, yĕlkă
Plenty River	—	—	—	elguma	ildya	—
Aranda	minta	tara	ilba	alkna	iltya	atua
„ , Mystic	knanyinta	tnalanga	tauana	reoara	beanga-kurka	ndoaritya
„ „	tyurura	tnalanga	ngarinya	mbakara	remba	antapara
Wychinga"	ninta	dramma	ilpŭkita	ugnaquirta	ilcha	adninga, arrilla

Aranda is one of the best-known languages of Australia. There are grammars by Kempe and Planert, vocabularies and texts by Strehlow, and a sociology by Spencer and Gillen.

4. *The Northern Territory.* Spencer and Gillen name more than 50 tribes of the Northern Territory. For most of these the only language-specimens are the numerals, a few relationship-names and very short vocabularies. The following grouping is provisional and partial:—(*a*) Melville Island; (*b*) Worgait, on peninsula west of Port Darwin; (*c*) Larrakia, at Port Darwin; (*d*) Warrai group, consisting of Woolwoonga, on the Adelaide; Warrai, between Port Darwin and Pine Creek; Awarra (?); Aggrakundi, near Pine Creek; (*e*) Djauan, on the Katherine and at the sources of the Daly and Roper; (*f*) Mungarai, on the middle Roper; (*g*) Yungman, on Elsey Creek; and Waduman, on the Roper; (*h*) Nullakun and Mara, both south of the Roper; (*i*) Mullukmulluk, Ngolokwanggar, Daktyerat, on the Daly; (*j*) Mudburra, on the upper Victoria; (*k*) Umbaia, north of Powell's Creek; and Umbria, at Anthony's Lagoon; (*l*) Kakadu, between the east and west Alligator Rivers; (*m*) Binbinga, between the McArthur and the Robinson, on the Gulf of Carpentaria; (*n*) Tjingili, east of the Robinson; Chingalee, between the Katherine and Tennant's Creek; (*o*) Coburg Peninsula Group, comprising Limbakaradja or Yarlo (*yarlo,* no), Port Essington; Oitbi (*oitbo,* no), Van Diemen Gulf; Jalakura, Mountnorris Bay; Unalla, Raffles Bay; (*p*) Woolna, east side of lower Adelaide; (*q*) Yaako or Terrutong (*yaako,* no), Croker Island and Raffles Bay; and Iyi (*iyi,* no), Popham Bay; (*r*) West Alligator River; (*s*) Allana, south-east of Daly Waters; (*t*) Caledon Bay.

	one	*two*	*ear*	*eye*	*hand*	*man*
Melville Is.	yătti, yerti	irara, urara	mikang-duna	pitchira	wamŭta	djidingurin
Larrakia	kalaguk	gălatilik	banarre	lemurra	gw'lăr-wira	biaba, birok
Woolwoonga	andore	garunklal	—	—	—	nul
Awarra	—	—	ann-gonnem	ann-dum	ann-abi	nalmok
Aggrakundi	uderin	—	—	—	ann-moa, abil	delnmulva
Katherine R.	—	—	—	undam	bărăk	kingulpoya
Roper R.	—	—	gowonda	marquil	—	—
Ngolok-wanggar	—	verina	djauel	numaro	nanyilk	yinya
Daktyerat	yaunuka	verenuka	monin-djauar	numuru	nanyuik	gnan, gnolan
Umbria	chandidgi	koodgarra	—	mooloo	labeera	boomutch
Kakadu	noorkudua m. wiorkudua f.	germinda m. genjida f.	kadi	poro	naije[1]	jereini, parla
Chingalee	tunka-bennee	ukadilla	lungah	ahbanjuh	munda munda	pia

	one	*two*	*ear*	*eye*	*hand*	*man*
Limbakaradja	erad	nargarik	alaijuh	ira	inbirjalk	iwala
Oitbi	warat	nargarik	kalajah	ira	adbirjalk	poli
Jalakura	warat	nargarik	alajah	ira	adbiljalk	—
Unalla	yardat	narakark	aljtjar	yarda	ambirkal	argbee
Woolna	tilingita, thidle	toloya	wol, wal	ma	itpaya, mani	looarki-einga
Yaako	roka	oralk	lomar	dala	manaweyi	eloin
Iyi	motu	laurtbari	jalamari	jara	jimilakodgi	koala
Caledon B.	—	—	pondooroo	mail	gong	—

	one	*two*
Worgait	nanji	burkĕta-malung
Warrai	enjerri	garanklul
Djauan	adjiri	tjert-kura
Mungarai	gnaumbana	gnabarana
Yungman	legga	quiamin
Waduman	leggo	quiamin
Nullakun	wŏngin	meiappan
Mara	wongin	yabban
Mullukmulluk	yaunuk	werina
Mudburra	tjindagu	kutjara
Umbaia	jandija	kutjera
Tjingili	kungupana	kutjeritja
Limbapyu (?)	immuta	lawidperra
West Alligator R.	minbara	gurat
Allana (?)	ganguji	kutjari
Bingonginga	yangalu	kutjera

There are no grammars; a few notes exist on Melville, Larrakia, Warrai, Ngolok-wanggar, and Kakadu. Gender in Kakadu extends to all natural objects, and numerals, pronouns and demonstratives change in agreement with the substantives they qualify: *jereini noorkudua* man one, *roulu noorkudua* stringy-bark-tree one, *ingordua wiorkudua* woman one, *peindi wiorkudua* stone one, *munedima* we men, *muniyembima* we women, etc. In Ngolok-wanggar a fourfold gender appears: *yinelli* a big man, *nunelli* a big woman, *wunelli* a big thing, *munelli* a big vegetable.

The pronouns show corresponding changes. The method of conjugating the verb varies, but all the languages appear to indicate person by a prefix, which changes for tense. Some verbal examples are:—Melville: *ngia a-beiya* I see; *inta ta-beiya* thou seest; *ngarra aura-beiya* he sees; *ngia ngu-puori* I go; *ngia ngira-puori* I went; Larrakia: *a-g'um* I say; *ne-g'um* thou sayest; *bi-g'um* he says; *bo-g'um* he said; *bara-g'um* he has said; *bin-g'um* he is talking; *nogolderk* (thou) run to me; *nogoldum* (thou) run from me; Kakadu: *ariy-eiring-ma* I dream; *meriy-eiring-mina* we two dream; *n-eiring-ma* thou dreamest; *n-eiring-mimina* you two dream; *d-eiring-ma* he dreams; *d-eiring-mimina* they two dream. The plural is formed by substituting *-mida* for *-mimina*.

5. *North-western Australia.* So far as they are known, the languages of north-western Australia fall into two groups. The first comprises the dialects about King Sound, and the second those in East Kimberley. The following are King Sound dialects:—(*a*) Sunday Island, Buccaneer Group; (*b*) Chowie, Ewenu Island; (*c*) Lower Fitzroy; (*d*) Napier Range.

The following are the East Kimberley dialects:—(*a*) Nowilnowillanna, lower Denham and Ord rivers; (*b*) Yamandil, Ord River; (*c*) Munmulla (Curramulla), west of the Ord River; (*d*) Walki (Chuanlinma or Kowrana), on Kimberley Goldfield, between the Margaret and the Ord; (*e*) Kisha, Hall's Creek, west of Munmulla.

	one	*two*	*ear*	*eye*	*hand*	*man*
Sunday Is.	aringk	kwir	nilimar	nimil	nemala	amba
Chowie	arinjie	kooyarra	neela-mur	nimmie	nemalla	umba
Lower Fitzroy	—	—	nilabubba	nemiljera	—	wamba
Napier Range	wingair	kujara	nilibib	nimilar	—	—
Nowilnowillanna	cherowi	panganyeri	yambirum	—	mallam	munamburri
Yamandil	—	—	karara	molu	—	—
Munmulla	cherowi	panganyeri	yardum	mula	mallam	munamburri
Walki	cherowi	kujara	yardum	molo	malla	munamburri
Kisha	nundi	buba	garding	mulji	murla	gerangen

The only grammar-note known concerns the Chowie language. In this the verb is conjugated by prefixes: *ngi nun-amoor* I throw; *jou min-amoor* thou throwest; *kinjing inn-amoor* he throws; *ngi arra nul-amoor* I throw not; *jou arra mil-amoor* thou throwest not; *kinjing arra ill-amoor* he throws not; *ngi nun-eep* I drink; *ngi kalla nun-eep* I drank; *ngi oong-eep* I will drink.

Linguistic Position of the Australian Languages. Many writers by arguments founded on defective material, and often by methods open to serious objection, have sought to establish a connection between the Australian languages, regarded as a single linguistic stock, and most of the other stocks. A brief résumé may be useful.

African. Bleek in 1872 somewhat doubtfully considered that there was a distant relationship between Australian and the Hottentot languages of South Africa, both being what he called 'sex-denoting languages.' In 1879 Hyde Clarke suggested a connection between the Yarra dialect of Victoria and the Bantu languages of Mozambique, and Curr in 1886 elaborated this theory to include languages of western Africa and the Sudan. The argument was based on the superficial resemblances of words; no reference is made to the radical difference which exists between African and Australian grammar, and Curr even disregards the difference between Bantu and Negro forms of speech.

Aryan. Some supposed miscellaneous affinities between Australian and Aryan languages were adduced by Brough Smyth and Taplin.

Andaman. Von Carolsfeld in 1890 suggested a relationship between the Andaman languages and Australian. He found some suffixes in both groups which were similar in form, though they differed entirely in meaning, and based his theory on these and on some resemblances in words. He paid no regard to the elaborate system of prefixes and infixes which forms the most important element of Andaman grammar, and is certainly absent in the southern languages of Australia. This theory was elaborated by Trombetti and Gatti in 1906.

Indonesian. North-western Australia is not far distant from the south-eastern part of the Malay Archipelago, where Indonesian languages come into contact with Papuan. Here there is a considerable mixture of vocabulary and grammar, unlike the ordinary Indonesian. Latham in 1844 affirmed a connection between the languages used on certain of these Malayo-

Papuan islands and the Australian. His view depended on imperfect vocabularies from Ombay, which were the only ones available; and his examples show only resemblances in a few words.

Dravidian. Norris in 1847 was the first to point out some resemblances between Australian and the Dravidian languages of southern India. These were approved by Bishop Caldwell in his *Comparative Grammar of the Dravidian Languages* (1875). They included a likeness in the agglutinate structure of the languages, the similarity of the pronouns, the use of post-fixes to nouns, the existence of two forms of the first personal pronoun in the plural number (one including and the other excluding the person or persons addressed), and the formation of verb-stems (inceptive, inchoative, causative and reflective) by additions to the verbal root. This theory was rejected by F. Müller, but partially adopted by Fraser and J. Mathew.

Munda or *Kolarian.* Professor Wilhelm Thomson of Copenhagen in 1892 tried to show a connection between the Munda languages of southern India and Australian, especially South Australian. His argument, based on vocabulary and grammar, was combated by Grierson in 1906.

Mixed. Two writers, Fraser and J. Mathew, ascribe a mixed origin to the Australian languages. The former adopts the Dravidian theory of Norris and Caldwell, but also finds a connection with other and diverse stocks, among which are the Munda, Papuan (undefined), Melanesian, Polynesian, Bantu, Aryan, Semitic and the so-called Turanian of northern Asia. The resemblances brought forward have no value. J. Mathew, assuming a threefold origin for the Australian languages, formulates a Papuo-Dravidian-Malay theory, without, however, accurately defining his terms. Papuan apparently includes Melanesian and various distinct Papuan stocks, and Malay excludes languages more primitive than itself. Mathew believed that the Tasmanians represented the primitive Australian stock, and that they were followed by Dravidians and, in a desultory manner, by Malays. At the same period, or later, Papuans or Melanesians mingled with Australians in the north and east of Queensland. Mathew's argument, like that of Fraser, is based entirely on the superficial resemblances of words; he does not affirm any grammatical identity of the various stocks. The argument fails because the resemblances between the words are often strained, and have no phonetic probability. The supposed likeness usually disappears when the words are analysed.

American. A comparison of Australian and American languages has been made by Dirr.

Among all these theories only two, the Dravidian and Papuan, have any claim to serious consideration. The likeness, however, between Dravidian and Australian is no proof of their genealogical connection, and it cannot be established that the two stocks are of common origin. The points of agreement noted by Caldwell were shown by F. Müller to be inconclusive. The grammatical features named are not possessed exclusively by the two groups, and the similar pronouns are found in languages totally different and spoken in far distant regions. There is also no general identity of grammatical particles in Australian and Dravidian, and no reliable correspondence in vocabulary. All that can be said with accuracy is, that the two groups—Dravidian and southern Australian—are of similar morphological type, i.e. agglutinate, with radical and functional changes of words expressed as a rule by suffixes.

On the other hand, many of the northern Australian languages resemble the Papuan (i.e. non-Melanesian) of New Guinea. They have the Papuan characteristic of diversity in vocabulary and grammar. Radical and functional changes of words are made not only by suffixes, but by prefixes and infixes. But, as the Papuan languages show no community of origin when one language is compared with another, it follows that the northern Australian languages cannot be expected to show any community with the Papuan of New Guinea, although one of them (the Saibai dialect of Mabuiag) is spoken almost within sight of New Guinea itself.

ABORIGINAL WORDS IN AUSTRALIAN-ENGLISH. Many aboriginal words have found their way into Australian literature, some locally, others generally throughout Australia. A few have been adopted in England. Morris estimates the number of these words at between 70 and 100. Some have been carried by the English from one district to another, and have been stigmatized as 'barbarisms,' because they were foreign to the particular district in which they were used.

The aboriginal words found in English are divided by Morris into three classes: (1) Aboriginal words which have been incorporated unchanged in the language, and which still denote the original object; (2) Aboriginal words similarly adopted, which have had their original meanings extended and applied to other things; (3) Anglicized corruptions of native words. To the first class belong a great many names of animals, plants, and objects and implements connected with the life of the natives. Some examples are:

Beasts: *kangaroo, wallaby*; *wombat*; *dingo*; *tuan, pongo* (flying-squirrel); *yarraman* (horse—not a wild horse); *jumbuck* (sheep).

Birds: *budgerigar, boobook, bulnbuln* (lyre-bird), *galah.*

Fishes: *nannygai, wobbegong, wollomai* (snapper).

Plants, fruits, etc.: *bangalay, boobyalla, bunya-bunya, karri, kurrajong, nardoo, pituri.*

Insects: *korrumburra* (blow-fly); *wichetty* (grub).

Persons: *koradji, boyla* (sorcerer).

Native Life: *mia-mia, gunyah, goondie, wurley* and *humpy* (all meaning 'hut' or 'shelter'); *boomerang, kiley*; *woomera, wommera* (throwing-stick); *leawil* or *leangle* (bent club); *nulla-nulla* (club); *mulga, hielaman* (shield); *coolaman* (water-vessel); *kurdaitcha* (shoe); *cooee* (a cry).

To the second class belong such words as *corroboree* (native dance); *bora* (initiation ceremony); *bunyip* (a fabulous monster); *gin, lubra* (woman; the latter is a Tasmanian word); *warrigal, myall* (a wild native); *billabong* (a blind effluent from a river); *mallee* (scrub); *bung* (dead).

Of the third class are such words as *paddy-melon* (a small wallaby); *pudding-ball* (a fish) *palberry* (native currant); *jarrah* (wood); *dilly-bag*; and possibly *barrack* (to jeer at).

Some words of apparently aboriginal origin are regarded as doubtful. Among these are *brumby* (wild horse); *waddy* (club, wood, fire-

wood); *jackeroo* or *jackaroo* (a 'new chum' working on a station); *yabber* (to speak).

One aboriginal word has enriched the vocabulary of chemical science. *Lerp*, a word meaning sweet, applied to a kind of manna secreted by an insect, has given its name to the chemical substance *Lerpamillum* derived from it.

BIBLIOGRAPHY. The earliest specimen of the aboriginal languages was obtained in 1770, during the stay of Captain Cook at the Endeavour River. It consists of a vocabulary of about 140 words, published in Parkinson's *Journal* in 1773. Shorter and slightly different lists were printed by Hawkesworth in 1773, and by Forster in 1778. These first records show the stability of the language; for King's vocabulary from the same place in 1827 and Phillips's in 1870 are easily recognizable as the Koko-yimidir language, used in the same neighbourhood in 1901. The accounts by Hunter in 1793 and Collins in 1798 of the first settlement at Botany Bay recorded words from the natives round Port Jackson; and these, with the vocabulary from the Endeavour River, were the only specimens of Australian languages known to Adelung when the *Mithridates* was published in 1806. Most of the early voyagers supplied short lists of words from various places. Flinders in 1814 and King in 1827 gave lists from the coastal tribes. Oxley in 1829 published the first inland dialect, from Limestone Creek. These were supplemented by Marsden in 1834.

The first *Australian Grammar*, that of the Hunter River dialect, was published by Threlkeld in 1834. It was followed by the Adelaide *Vocabulary* of Williams, those of Raffles Bay and south-western Australia by Wilson and Grey, and the collections of Eyre; also by the Adelaide grammar of Teichelmann and Schürmann in 1840, and those of Meyer for Encounter Bay, Schürmann for Port Lincoln, and Moorhouse for Murray River. In 1847, Hale, the philologist of the United States exploring expedition, published grammars of the Lake Macquarie and Wellington dialects, based on the work of the missionaries Threlkeld and Watson. Very little was published in the fifties, only Earl's vocabularies from the north and Salvado's *Memorië Storiche* being noteworthy; but interest revived from 1863 onward, and several short lists were published, with a collective vocabulary of 12 dialects, on the occasion of the Melbourne Exhibition in 1867, and a discussion of the languages by Müller in the Linguistics of the *Novara* expedition in the same year. The first Scripture translation (Narrinyeri) appeared in 1864, and the first edition of Ridley's *Kamilaroi* in 1866. Attempts were made in the seventies to preserve some of the fast-disappearing languages in the south and east; hence the collective works of Brough Smyth on Victoria, Woods on South Australia, Taplin on Narrinyeri, and Ridley (2nd edition) on Kamilroi. The following decade (1880-1890) was marked by the publication of many vocabularies—among them the great collection of Curr—but very few additions were made to a knowledge of the grammar. This deficiency was partly made up by the industry of R. H. Mathews from 1900 to 1908, and by the works of Fraser, J. Mathew, Roth, Kempe, and Tuckfield. Since 1900 a few grammatical works have been published, the chief being Roth's *Kokoyimidir*, Hey's *Ngerrikudi*, Planert's *Aranda* and *Dieri*, and the northern grammars in the *Report* of the Cambridge expedition.

A very large number of vocabularies have appeared in many periodicals, though their value is impaired in many cases by the adoption of erratic and unscientific modes of spelling.

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Aborigines. It is probable that, with the exception of one or two isolated groups in other parts of the world, the Australian aborigines represent the most archaic people extant and, in many respects, reveal the conditions under which the early ancestors of the human race existed. It must, however, be remembered that, from the point of view of savage life, conditions in Australia, during the time that it has been inhabited by human beings, have differed much from those in Europe, Asia, Africa, and America. In the first place, Australia has never been stocked with wild animals dangerous to human beings, nor with any apparently suitable for domestication. Even supposing there had been domesticable animals, it is quite possible that the aboriginal would have done nothing with them. He grinds many sorts of grass-seed to make into crude cakes; but it never occurs to him to sow the seed, and so insure a certain amount of food supply. In many tribes this

is to be associated with the fact that he knows nothing of the relation between the seed and the plant, and thinks that the latter grows because he makes it do so by means of magic. Secondly (and this is, perhaps, the more important reason) the Australian aboriginal, since his ancestors first inhabited the continent, has never had to contend with any higher race. He has developed along his own lines without the impetus given by competition with other peoples. In Europe early man had to contend with the bison, rhinoceros, tiger, lion, bear, and hyaena —a condition which must have sharpened his wits; in Australia he has had nothing more fearsome to meet than huge diprotodons and giant kangaroos, which were quite as anxious to get away from him as he was to capture and eat them. All that he has had to contend with have been men of his own or a lower level, and (at times and in certain parts) climatic conditions that trained him to habits of keen observation. There has been much speculation in regard to the origin of the present Australian race. In past times the whole of the continent (including Tasmania) was, presumably, occupied by one race. This original—probably ulotrichous—population was at an early period widely spread over Malaysia and Australia. Tasmania at that time was not cut off by Bass Strait, for the Tasmanians had no boats capable of crossing it, and must have gone over on land. Subsequently the land sank, leaving the higher parts above water in the form of King Island on the west, and the Kent, Furneaux and Flinders Islands on the east. A remnant of the old ulotrichous population was left stranded in Tasmania, where *Homo tasmanianus* survived until he came in contact with Europeans and was exterminated. There seems to be no doubt about this subsidence; what happened next is not so clear. *Homo tasmanianus* had the frizzly (ulotrichous) hair characteristic of negroid races. His weapons and implements were of the most primitive kind; no spear-thrower, no boomerang, only long, pointed, unbarbed spears, simple throwing-sticks, and the crudest form of unhafted, chipped stone axes, knives and scrapers. Of his organization, customs, and beliefs we know but little in detail. It is often (indeed usually) assumed that (1) at a later period an immigration of a higher race took place into Australia, and that (2) this race blended with the older inhabitants of the continent to produce the present Australian race. In regard to the first of these two assumptions every one is agreed, but in regard to the second there is room for grave doubt. It has been suggested that the two races are represented by the two primary moieties or phratries characteristic of Australian society, sometimes designated by names indicating a contrast of colour, such as 'eaglehawk' and 'crow.' The crow, black cockatoo, etc., would represent the Tasmanian element; the eaglehawk, white cockatoo, etc., the so-called Dravidian. It cannot, however, be said that the names—except in a few cases, and these representing only a small part of the continent—lend any serious support to the theory of the mixture of two races differing in colour. A certain amount of Malay intermixture in the north has also been suggested, but of this there is no evidence. In regard to language Sidney H. Ray says 'There is no evidence of an African, Andaman, Papuan or Malay connection with the Australian languages. There are reasons for regarding the Australian as in a similar morphological stage to the Dravidian, but there is no genealogical relationship proved.' They are pure nomads, the members of a tribe hunting over the land that has belonged to their ancestors, and not encroaching on that of others. They have favourite camping grounds, on which they build bark or brush *mia-mias*, or shelters, and where they stay as long as food and water supplies are abundant, moving on when these become scarce. During the day they are out in the scrub, the men hunting larger game, the women and children in search of smaller animals, grass-seed and yams. Attention has often been drawn to their great power of tracking, a faculty which they must cultivate if they are to live. Their evenings are spent in the performance of the ordinary dances, called corroborees; as a general rule, only men perform, while the rest of the camp makes the audience. Each corroboree has its own decorations and songs, and may occupy the evenings of two or three weeks. Apart from this ordinary camp life, there is, however—so far as the men are concerned—quite another side, which may be spoken of as the ceremonial. It is difficult to say how much time is occupied by this, but in many tribes weeks or even months are spent yearly in attendance upon, or taking part in, ceremonies of a sacred nature that only initiated men may witness; and the older a man becomes the more time he spends in this way.

Finally it must be remembered that, owing to the vast area over which the tribes are scattered and the very different conditions under which they live—some exposed to the often fierce heat and droughts of the interior, others living amongst shady forests in the south-eastern ranges, and others again in the far north camped by the side of rivers and pools where there is a constant and plentiful food supply—there are necessarily great variations in customs, organization, and beliefs. The different tribes may be regarded as descended from ancestors who all observed certain customs and were regulated by a common social organization. In course of time, as they wandered over the continent and became divided into isolated groups, they developed along different lines; yet in essential features the resemblance of their customs, beliefs and organization is remarkable.

W.B.S.

Origin. It is now fairly certain that man's nearest living relatives are the anthropoid apes—the gorilla, orang, gibbon, and chimpanzee. He possesses in common with the gorilla and the chimpanzee about three hundred structural features that are not found in any of the lower monkeys. Turner has pointed out that the simian features are not all concentrated in any single race, but it is allowed that the Australian aborigines exhibit the largest number of apelike characters, and belong to one of the most primitive (in the sense of oldest) races of mankind. It is supposed that Neanderthal man and men of his type, who have long been extinct, lived for many thousand years contemporaneously with a *Homo* of another type, and that from this other type the modern races have sprung. One notable character of Neanderthal man—in fact, the feature most obvious to ordinary observation—was the forehead with its large glabella and prominent superciliary ridges; and it was once thought that this showed an affinity, if not a racial connection, between that type and the aboriginal such as existed in no other modern race. But this character has been found in individuals of the most modern type—Sir

William Turner found it in the skull of an Aberdeenshire Scot; and evidence from embryology and genetics has shown that in the aboriginal this peculiarity is almost certainly a late development. Other considerations, too, have led recent anthropologists to regard the aboriginal as part of the bundle of present-day races, having no more radical or racial connection with the Neanderthal type than any of the others.

In anthropology the term 'race,' used strictly, is applied to one of the larger divisions of mankind whose members have certain physical characters in common. The most important features in the classification of races are the characters of the hair and the form of the head, which are remarkably constant in the chief divisions of mankind. These divisions may be called 'White,' 'Black,' and 'Yellow.' In which of them is the aboriginal to be included?

First it is to be noted that some writers class the Australian aborigines as a distinct race, equipollent to the three others, on account of their numerous and remarkable characteristics. In order to account for apparent 'varieties,' local or sporadic, two types have been assumed —a black type, which differs, however, from all negroid races in the character of the hair, and a Caucasian melanochroic type. Several modifications of this hypothesis have been suggested; but Professor Sir Arthur Keith gives us a new view-point when he says: 'Of all the races of mankind now alive, the aboriginal race of Australia is the only one which, in my opinion, could serve as a common ancestor for all modern races. The common ancestor has to yield descendants which, on the one hand, might become the typical inhabitant of central Africa, and, on the other, the fair-haired native of north-western Europe. The Australian native has those intermediate and generalized characters needed for such an ancestral form.'

If the Australian aboriginal is the nearest to the original stock, what are his affinities? Formerly he was classed with the negro, because both possessed a flat nose, protruding lips, projecting jaws, and large-sized teeth. But this is just as if one should class the echidna and the porcupine in the same order on account of the similarity of their spines, totally disregarding their broad and fundamental structural distinctions. The characters mentioned are very variable, not only in the Australian aborigines and in the negroes but in all races, and are just those characters that change very rapidly in individuals and in the race on account of changes in environment and habits. Further, they are the characters that would become specially developed and fixed in apes and in the lower human races on account of similarity of food, habits, and surroundings.

With respect to the brain Professor Elliot Smith has been able to do a great deal towards establishing which anatomical characters should be considered primitive, which should be accepted as evidence of specialization, and what value should be attached to the various features of the brain as an indication of specialization and racial affinities. By applying the criteria he has established to Australian aboriginals' brains, Dr. J. F. Flashman was able to say (with a fair amount of certainty considering the all-too-limited material at his disposal) that, on the important points that count, the aboriginal shows undoubted primitive racial features. Other parts of the body also furnish evidence; for example, the molars and wisdom teeth in the aboriginal's upper jaw develop in a manner quite different from that noted in 'white' men, but similar to that seen in certain lower animals. Researches on this subject have not as yet been extensive enough to enable one to say what other races, if any, exhibit a process of dental development similar to that of the aboriginal; but this form of development sometimes occurs in white individuals, and may on occasion give rise to one form of the condition known as 'impaction of the wisdom.'

Again, it was believed until recently that the shin-bone in the Moriori (the original inhabitants of New Zealand, whose last members survived in the Chatham Islands) showed a nearer approach to the sabre shape in its upper part than occurs in any other race; in other words, its platycnemic index was the lowest. Now, however, it has been found that the Australian aboriginal shows indices very much lower than those of the Moriori. In this respect, then, these two races are brought into close affinity. The same condition is found in the shin-bones of prehistoric man, and in all the anthropoid apes except the orang. A condition associated with this—retroversion of the head of the shin-bone, which is very marked in the aboriginal—also occurs in prehistoric man and in the human embryo in all races, but disappears early in Caucasian children, persisting, however, in some of the lower races.

It is accepted as almost indisputable that the Australian race is not autochthonous, but that it migrated from some distant centre to its present habitat. While this view is possible, the subject demands re-examination in the light of Professor Alfred Wegener's recent studies. Many hypotheses have been formulated regarding its previous habitat. Topinard and others concluded that Australia was originally inhabited by a race of the Tasmanian type, which disappeared before a taller race that came from parts unknown. Flower and Lydekker (1891) thought the Australians were a cross between two already-formed stocks. Keene still considers that they are a blend of two, or at the most three, different elements in extremely remote times. Huxley held that they were a homogeneous group. Finsch (1884) from extensive observations concluded that they were all of one race. Alfred Russel Wallace (1893) pointed out the aboriginal's resemblance to certain Asiatic races—the Veddahs, Todas, and Ainus—and concluded that he was really a low Caucasian type.

Dr. Semon (1899) in his work *In the Australian Bush*, adopts and defends the theory that the Australians and the Dravidians (primitive inhabitants of India) have sprung from a common branch of the human race, and that the Caucasians have undoubtedly sprung from the Dravidians. This makes the Australian aboriginal more nearly allied to us than the comparatively civilized Malays, Mongols, or Negroes; according to this view, indeed, the Australian aboriginal would be racially the uncle of the Caucasian. According to another view, by which the Veddahs as a primitive type gave origin to the Dravidians and the Australian aborigines, the two latter would be brothers. Lydekker (1898) abandoned the two-race theory, and reached independently the same conclusion as Wallace. Most anthropologists now accept the one-race theory. Professor Gregory in *The Dead Heart of Australia* accepts this view and abandons his former position.

Some writers give the Australian even greater importance. Stratz has taken him as a central unit, a prototype, around which he groups all the rest of the races of men; Schoetensack holds that all races of men were evolved in the Australian continent. The unity of the race may be accepted as established. The latest word on the subject is Sir William Turner's (1908); 'The balance of opinion is indeed in favour of the view that throughout Australia the present natives generally conform to one pattern in features, colour, and mental character; though possibly on the coast, local infusion of Papuan, Polynesian or Malay blood may from time to time have been introduced amongst them. Indeed, as Giglioli has suggested, the idea of an existing woolly-haired race in Australia is probably due to the loose way in which the terms woolly and crisp have been used by explorers who were not anthropologists.'

It may therefore be taken as established that the aborigines are a homogeneous race, unmixed in descent, of Caucasian stock, not negro or negrito, but differing from every race in geographical propinquity to them in their physical characters and language, and in the absence of pottery, agriculture, sea-craft, bows and arrows, and architecture—a primitive race, a relic of the oldest human stock. Yet we must not draw too wide an inference from mere casual examination, and we must be prepared to find a large amount of well-marked variation. The examination of a number of aboriginals will show facial resemblances to all the known recognized human types, Ethiopian, Mongolian, Caucasian, American. In this respect there is an analogy between the Australian aboriginal and the Australian fauna. The primitive marsupials, distinguished by certain features—such as epipubic bones, inflected angle of the lower jaw, aplacentation, double uterus, etc.—were cut off at an early period from competition with nearly all other classes of mammals. The requisites for individual and racial life are food and safety; and since, among mammalian forms, the kinds of food are limited, and the means of overtaking, seizing and disposing of it are also limited, the limbs, teeth, and intestines become specialized along similar lines in animals living on similar diet (e.g. carnivora, graminivora, insectivora) according to the circumstances of the localities in which they have been evolved. Such convergence in evolution is illustrated in an extreme degree, for example, in the bodily outlines of the piscine shark and the mammalian whale. Not only so, but racial characteristics which have been looked upon as fixed in a people, may become very much changed within a comparatively short time by changes of food and environment.

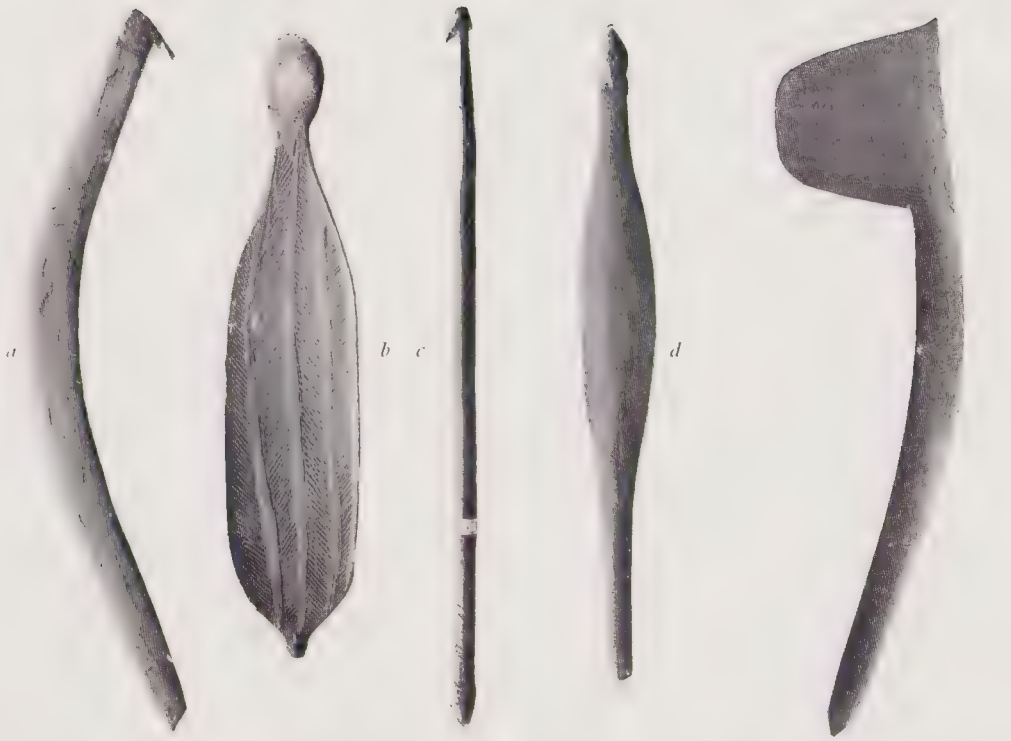
As to the physical and mental differences found in tribes in various parts of the continent—say in the Alligator River district and in certain parts of central Australia—it was pointed out long before Darwin's day that food and climate and mental degradation will, within a comparatively short time, cause enormous variations in the people. Analogous changes may be seen in Americans who tend to a Red Indian type of face, neck, and vocal organs, and also in Europeans who have migrated to Australia and in their descendants.

In 1839 Dr. Charles Pickering visited Australia as a member of the United States Exploring Expedition commanded by Wilkes. He records that an hour after landing at Sydney he met an aboriginal in the street, wearing European costume, whom he instantly recognized; and this single example seemed to dispel all danger of subsequently confounding the Australian with any other race of men. He subsequently saw two or three dozen aboriginals in the settled parts, and thus described them: 'Some individuals were of surpassing ugliness; while others, contrary to all anticipation, had the face decidedly fine; and several of the young women had a very pleasing expression of countenance . . . . Strange as it may appear, I would refer to an Australian as the finest model of the human proportions I have ever met with; in muscular development combining perfect symmetry, activity, and strength; while his head might have compared with the antique bust of a philosopher.' W.R.S.

Distribution. Wegener, from investigations regarding the distribution of the ancient rocky crust of the earth, the structure and position of the great continental mountain ranges, the correspondence between the contours of the continents on opposite sides of the Atlantic, bathymetric surveys of the oceans, palaeontological researches in the continents, the geographical distribution of animals, and astronomical data, infers that Australia up to the beginning of Jurassic times was connected in the west with India and Ceylon, and through them with Madagascar and South Africa; and after breaking away from India it was still, perhaps as late as Eocene times, connected through Antarctica with South America. Two other recent lines of investigation must be correlated with Wegener's theory. One concerns the question How long has man, as man, existed on the earth; the other concerns the region where we are to look for his lineal progenitors. Such a correlation would appear to furnish materials for a theory that man originated somewhere in, and spread from, an extensive land-mass consisting of a southern continent continuous with Africa, southern Asia and Australia; that his origin dates back many hundreds of thousands of years; that the ape families were his collaterals, not his progenitors; and that the Australian aboriginal is probably, amongst surviving peoples, nearest to the primary stock and not impossibly the source from which many, if not all, of the other peoples originated. There is perhaps more scientific foundation for this theory than for many that have been advocated.

The puzzling problems of migration would be much simplified if the proof of Wegener's theory were complete, and if further evidence bore out recent statements regarding the age and origin of man and the place of the Australian aboriginal among mankind. But it may be well to set forth some of the theories regarding the peopling of the Australian continent that were put forth before the question above referred to was considered or propounded.

It is generally supposed that the Australian continent became peopled from a centre in the north or north-west by tribes that dispersed or migrated in certain definite directions. These lines of migration are defined according to the occurrence along them of tribes possessing similar physical characters, dialects, traditions and customs. The fact that adjacent tribes often show considerable differences in these respects is explained by supposing that they arrived at these particular places at different times and by different routes, having acquired variations in the process of migration.



1. WOMMERAS
a. Queensland
b. Western Australia
c. and *d*. Lower Murray, South Australia

2. LIL-LIL, Lower Murray

FISH TRAPS ON DARLING RIVER, CONSTRUCTED BY ABORIGINES

With the limited knowledge of dialects, weapons, habits, customs and traditions of the various tribes at his disposal, Eyre hazarded the opinion that

> Australia was first peopled on its north-western coast, between the parallels of 12° and 16° S. latitude. From whence we might surmise that three grand divisions had branched out from the parent tribe, and that from the offsets of these the whole continent had been overspread. The first division appears to have proceeded round the north-western, western, and south-western coast, as far as the commencement of the Great Australian Bight. The second, or central one, appears to have crossed the continent inland, to the southern coast, striking it about the parallel of 134° E. longitude. The third division seems to have followed along the bottom of the Gulf of Carpentaria to its most south-easterly bight, and then to have turned off by the first practicable line in a direction towards Fort Bourke, upon the Darling. From these three divisions various offsets and ramifications would have been made from time to time as they advanced, so as to overspread and people by degrees the whole country round their respective lines of march. Each offset appearing to retain fewer or more of the original habits, customs, &c. of the parent tribe in proportion to the distance traversed, or its isolated position, with regard to communication with the tribes occupying the main line of route of its original division; modified also, perhaps, in some degree, by the local circumstances of the country through which it may have spread. (Eyre's *Journals*, ii.405.)

Eyre also expressed his confidence that the precise original divisions and the routes of distribution might be determined when more particulars were collected regarding the various tribes; it is to be feared, however, that there is less hope now of doing this than there was in his time. Further study by Howitt, Spencer, and Gillen would lead to the conclusion that there were three main lines of distribution, corresponding roughly to those laid down by Eyre. The chief evidence is founded on the occurrence in the various tribes of similarities in grammar and dialects, the practices of circumcision, sub-incision and knocking out certain front teeth, and other observances.

How long have the aborigines been here? As yet no fossil remains yield such trustworthy evidence as would enable one to make a likely guess; there is no Stonehenge or Great Pyramid from which one could theorize astronomically on the subject of their possible presence. Some facts point to long residence on the continent. One of these is the differentiation in language. Eyre says that the variations of dialect are frequently so great that a person thoroughly acquainted with one dialect has not the slightest clue to what is said by a tribe speaking a different one. Eyre and others note that many aboriginals cannot give any interpretation of the dance songs in their own districts. This would seem to point to a common origin of their plays and dances.

It is obviously impossible at the present time to form any accurate estimate of the numbers of aborigines in various parts of the continent towards the end of the eighteenth century. Not until men like Grey, Eyre, Threlkeld, Teichelmann, M'Combie, Meyer, Schürmann, Taplin, Wyatt, and Gason began to write and record, do we find materials available for estimating the number existing over half a century ago; and what impresses one in the writings of all these observers is the extreme difficulty they encounter in arriving at even an approximation of the number of the aborigines. Eyre despairs of forming any opinion, even approximating the truth, of the aggregate population of the continent, or the average number of persons to be found in any given space. A district, he says, that may at one time be thinly inhabited, or even altogether untenanted, may at another be teeming with population. The wanderer may at one time be surrounded by hundreds of savages, and at another, in the same place, may pass on alone and unheeded. Grey says he has found the number of inhabitants to a square mile to vary so much from district to district, from season to season, and to depend upon so great a variety of local circumstances, that he is unable to give any computation which would even nearly approach the truth. Modern writers, however, show remarkable unanimity in recording the aboriginal population at 150,000 at the time of the settlement of Europeans. If there were any means of proving or disproving the correctness of the estimate something critical might be said regarding it. All that can be said is that it is a guess.

As for the extreme variations noted by Eyre and Grey, we should note that, according to Woodruff, in the eolithic or protolithic stage perhaps all Europe contained but a few thousand men, widely scattered in tiny groups; even in the next (neolithic) stage but few existed, and in the bronze age there were no dense masses: the Veddahs of Ceylon, one of the lowest types at present, scarcely number 2000 though inhabiting vast areas. Current ideas as to the density of population in ancient civilized times are usually very erroneous. When our ancestors in Denmark were in a stage of culture corresponding to that of the Australian aborigines, only 500 could live in the 15,000 square miles of that country. When one considers the vast differences in range and characters of climate and environment between Europe and Australia, one sees the necessity for caution. The conditions affecting existence and evolution may have been very different in Australia from those that have obtained anywhere else in the world.

When we inquire into the numbers in districts occupied by Europeans at the time when observations were attempted, we find that observers had great difficulty in forming conclusions. In South Australia (not including the Northern Territory) Moorhouse concluded that in 1843 there were about 1600 aborigines in regular or irregular contact with the Europeans distributed in the Adelaide district, Encounter Bay, Moorundie, Port Lincoln, and Hutt River. If the districts within 120 miles S., 160 miles N., and 200 miles E. of Adelaide were included, he estimated that the total would be about 3000. Eyre thought there must be about twice as many. J. D. Woods, on the basis of Eyre's estimate, calculated that there might be about 12,000 in all in South Australia. In the districts to which Moorhouse referred few now survive. With the exception, perhaps, of a solitary member, the Gawler, Adelaide and Port Adelaide tribes are extinct. Not one individual survives in the Kapunda, Burra, or Rufus districts. In 1840 the Narrinyeri tribe numbered about 3000; in 1877 it had dwindled to 613; in 1909 only two individuals survived. The hundreds or thousands of blacks in the Murray district 80 years ago are represented to-day by a score or so at the Point Macleay mission station on Lake Alexandrina. M'Combie says that Victoria, when first colonized, contained as many as 7000 aboriginals, but that in 1858 the number had dwindled to 300. The latest (census of April 1921) official estimate for that State is

With the limited knowledge of dialects, weapons, habits, customs and traditions of the various tribes at his disposal, Eyre hazarded the opinion that

> Australia was first peopled on its north-western coast, between the parallels of 12° and 16° S. latitude. From whence we might surmise that three grand divisions had branched out from the parent tribe, and that from the offsets of these the whole continent had been overspread. The first division appears to have proceeded round the north-western, western, and south-western coast, as far as the commencement of the Great Australian Bight. The second, or central one, appears to have crossed the continent inland, to the southern coast, striking it about the parallel of 134° E. longitude. The third division seems to have followed along the bottom of the Gulf of Carpentaria to its most south-easterly bight, and then to have turned off by the first practicable line in a direction towards Fort Bourke, upon the Darling. From these three divisions various offsets and ramifications would have been made from time to time as they advanced, so as to overspread and people by degrees the whole country round their respective lines of march. Each offset appearing to retain fewer or more of the original habits, customs, &c. of the parent tribe in proportion to the distance traversed, or its isolated position, with regard to communication with the tribes occupying the main line of route of its original division; modified also, perhaps, in some degree, by the local circumstances of the country through which it may have spread. (Eyre's *Journals*, ii.405.)

Eyre also expressed his confidence that the precise original divisions and the routes of distribution might be determined when more particulars were collected regarding the various tribes; it is to be feared, however, that there is less hope now of doing this than there was in his time. Further study by Howitt, Spencer, and Gillen would lead to the conclusion that there were three main lines of distribution, corresponding roughly to those laid down by Eyre. The chief evidence is founded on the occurrence in the various tribes of similarities in grammar and dialects, the practices of circumcision, sub-incision and knocking out certain front teeth, and other observances.

How long have the aborigines been here? As yet no fossil remains yield such trustworthy evidence as would enable one to make a likely guess; there is no Stonehenge or Great Pyramid from which one could theorize astronomically on the subject of their possible presence. Some facts point to long residence on the continent. One of these is the differentiation in language. Eyre says that the variations of dialect are frequently so great that a person thoroughly acquainted with one dialect has not the slightest clue to what is said by a tribe speaking a different one. Eyre and others note that many aboriginals cannot give any interpretation of the dance songs in their own districts. This would seem to point to a common origin of their plays and dances.

It is obviously impossible at the present time to form any accurate estimate of the numbers of aborigines in various parts of the continent towards the end of the eighteenth century. Not until men like Grey, Eyre, Threlkeld, Teichelmann, M'Combie, Meyer, Schürmann, Taplin, Wyatt, and Gason began to write and record, do we find materials available for estimating the number existing over half a century ago; and what impresses one in the writings of all these observers is the extreme difficulty they encounter in arriving at even an approximation of the number of the aborigines. Eyre despairs of forming any opinion, even approximating the truth, of the aggregate population of the continent, or the average number of persons to be found in any given space. A district, he says, that may at one time be thinly inhabited, or even altogether untenanted, may at another be teeming with population. The wanderer may at one time be surrounded by hundreds of savages, and at another, in the same place, may pass on alone and unheeded. Grey says he has found the number of inhabitants to a square mile to vary so much from district to district, from season to season, and to depend upon so great a variety of local circumstances, that he is unable to give any computation which would even nearly approach the truth. Modern writers, however, show remarkable unanimity in recording the aboriginal population at 150,000 at the time of the settlement of Europeans. If there were any means of proving or disproving the correctness of the estimate something critical might be said regarding it. All that can be said is that it is a guess.

As for the extreme variations noted by Eyre and Grey, we should note that, according to Woodruff, in the colithic or protolithic stage perhaps all Europe contained but a few thousand men, widely scattered in tiny groups; even in the next (neolithic) stage but few existed, and in the bronze age there were no dense masses: the Veddahs of Ceylon, one of the lowest types at present, scarcely number 2000 though inhabiting vast areas. Current ideas as to the density of population in ancient civilized times are usually very erroneous. When our ancestors in Denmark were in a stage of culture corresponding to that of the Australian aborigines, only 500 could live in the 15,000 square miles of that country. When one considers the vast differences in range and characters of climate and environment between Europe and Australia, one sees the necessity for caution. The conditions affecting existence and evolution may have been very different in Australia from those that have obtained anywhere else in the world.

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111. For the other States the numbers are:—New South Wales, 1501; Queensland, 12,614; South Australia, 1609; Western Australia, 25,587; the Northern Territory, 17,349—a total of 58,771, rather more than 54 per cent being males. This is probably the most accurate estimate yet made in connection with any census.

W.R.S.

Physical Characteristics. The Australian is a primitive race. This established and accepted fact, taken in conjunction with the superficial observations of early explorers, the misrepresentations of some of the early settlers, and the inaccurate reports of later writers, has given rise to an impression that it is also a degraded race. But primitiveness and degradation are not synonymous. Hand-reaping by hook or sickle is a primitive method of harvesting compared with the self-binder or the stripper, but it is not on that account degrading. The Australian race is not degraded, physically, mentally, or morally. Some individuals and some tribes may exhibit inferior and degraded traits, but the race as a whole shows no signs of retrogression or degeneration.

The average height of the aboriginal is little, if anything, less than of the Englishman. Very tall individuals, over six feet, are not uncommon, and may occur anywhere. At 21 years of age, David Lindsay's boy, Dick Moogee, from central Australia, was 6 feet 6 inches high. Brough Smyth records an adult male as measuring only 5 feet 1 inch. Measurements vary greatly with locality. Women are usually about from five to six inches shorter than men. The upper part of the body is usually better developed than the lower. The legs and arms are longer, relatively to the trunk, than those of Europeans. It is noteworthy that this feature appears in certain ancient Grecian works of art which have been regarded as of the greatest beauty, and that this perfection of elegance seems to depend on the apparent abnormality—that what was for long regarded as 'so unaccountably excellent in its general appearance, hath been owing to what hath seemed a blemish in a part of it.' In many aboriginals the legs lack girth (especially in the calves), but many show excellent proportions, and are well-built and muscular. The wrists and hands are finely formed. The hands are distinctly small, and remarkably narrow. Brough Smyth says, 'It would be impossible to find in a tribe of Australians such hands as are seen amongst the working classes in Europe. An English ploughman might perhaps insert two of his fingers in the hole of an Australian's shield, but he could do no more.' The lunule of the finger-nail is as well marked in the Australian as in the European. The men have deep and broad chests. They may remain lithe, active and supple to a very great age; the women, as a rule, 'go off' in condition early, probably on account of the hard work and privation to which they are subjected.

The skull of the aboriginal is long, the sides are nearly vertical, and the vault is strongly rafter-like or roof-shaped. The forehead is low and flat. Its lower part (the glabella and superciliary ridges) is strongly marked. The hair is long and straight, wavy or curly, never woolly like the negro's, and not frizzly except from manipulation It is generally worn short by both sexes, and is usually abundant and of a silken, glossy appearance. The practice of depilation is common, the hair on different parts of the body being removed for various reasons. This practice is sometimes connected with initiation ceremonies. In colour the hair is very dark brown, or black; its shaft, in section, is oval and relatively thick, though one meets with many specimens of fine silky hair. In some women the hair is as black and lanky as among Mongolians. Beards and moustaches are common; even women sometimes grow strong grey beards and moustaches. The hair turns grey on all parts. Baldness is almost unknown; when it occurs, it appears to begin at the forehead and to extend backwards. The skin is usually velvety in smoothness and is chocolate-brown, or of a dark copper colour; it varies much in its depth of tint, largely in accord with the amount of exposure to which it has been subjected. When thoroughly clean it may show marked iridescence. The sooty tinge of the African negro is said not to occur. The skin of the newly-born child is of a light reddish or honey colour, but in two or three weeks becomes dark. The bodies of children are often covered by long, soft, downy hair, especially along the spine; their skin shows the same varieties of tint as that of older people. The aspect of the face varies greatly in tribes and in individuals. The eyes are sometimes said to be far apart, sometimes to be near, but examination shows that in this respect they resemble those of the European. They are deeply set, and of a dark brown or reddish-hazel colour, soft and intelligent, with black eyelashes. The pupils are large and dark, and the 'whites' are yellowish. The blackfellow is said to have much keener vision than the European; but vision, like some other senses, is so much a matter of inference and cultivation that the statement requires qualification. The deep notch at the root of the nose and the overhanging brows are very characteristic. These characters are very quickly 'bred out' in crossing with the white, and the same is true also of the dark colour of the skin. As in the case of the Maoris, the progeny of half-castes with half-castes or whites is nearly white; but instances in which some or all in a family may revert to the black show that the heredity of these half-castes requires investigation. The nose is very flat and very wide. The excessive width of nose and the openness of the nostrils is usually ascribed to the custom of wearing a 'nose stick,' but it is well-marked in young children. A Jewish cast of countenance, possibly more apparent than real, is frequently and widely met with. The mouth is wide; the lips are rather thick, but not swollen like those of the negro's; and the jaws are usually somewhat projecting. The teeth are large, well-formed, regular; in the uncivilized individual they may be evenly worn from excessive use, but are never decayed. Irregularities are almost invariably due to crowding in the front part of the jaws. The grinders are of large size; the wisdoms may be as large as, or larger than, the first and second molars—a very characteristic feature. The upper jaw in the vast majority does not overhang the lower, but bites flush against it. The cheek-bones are often high, and the chin receding. The neck is short and thick. The ankles are small. The heel resembles that of the European. The forepart of the foot is usually very broad and thick, the great toe is 'loose,' and a native can as readily pick things up with his foot as he can with his hand. The carriage of the aboriginal is graceful, with the trunk erect, the head thrown back and the knee lifted forwards in a peculiar

fashion rarely seen in any other race. One can hardly be said to have seen human grace of carriage who has not seen an aboriginal walk. In sitting on the ground, which is his usual custom, the blackfellow crosses his legs and brings his heels nearly under him; a woman usually sits almost on her knees with one foot right in the crutch. These positions, like the difference in the 'fighting fist' of whites, seem to be sexual distinctions. The men in standing often place one foot against the opposite knee and help to balance themselves with a wommera or some other weapon or implement. Even the young children naturally assume this figure-of-four pose.

At one time it was supposed that the aboriginal exhibited few, if any, bodily abnormalities. Extensive observations, however, have shown that the anatomical abnormalities and variations found among aborigines are probably much more numerous than in any other known race, ancient or modern.

The body exhales an odour quite characteristic of the race, noticeable by whites, horses, cattle, and dogs, just as the odour of the white man, which is imperceptible to himself, is noticeable by the black man. Perhaps the Japanese is the only race that is odourless in this sense. The voice is soft and musical, and rich in inflections. The traditional geisha-singing in Japan, which has come down for hundreds of years through artists and trainers, and which strangers rarely witness, is a marvellous combination of bodily pose and musical expression, and yet an embodiment of ease and repose; the voice inflections are different from anything heard elsewhere in music—the nearest approach to them that I know is the pleading, coaxing, wheedling, whining tones of an Australian gin begging tobacco.

Mentally the aboriginal in his native surroundings is observant, self-reliant and quick. Under civilization, however, he appears to lack stability, probably because he faces uncongenial conditions in a new environment. Children in school can be educated like white children, and to the same extent, and the aboriginal parents object to any distinction in the curriculum or the standard required. It is usually said that they never progress beyond a certain stage, and that in arithmetic particularly they are deficient, being unable to count above two or, at the most, four. There is no evidence for such assertions. In some uncivilized tribes there are numerical names for children up to the number of ten. A blackfellow, born of uncivilized parents and brought up among whites, or mixing a great deal with them, will tell the distance between two places thus: A to B, 10 miles; B to C, 6; C to D, 14; D to E, 8; E to F, 5; and say the total, 43, without a halt. The ordinary blackfellow is as good at figures as his white brother. Some speak English chastely and beautifully. Some train themselves in music, and can play classical choruses and similar pieces on the organ with great skill and expression. Some show great mechanical ingenuity, and read and understand books on mechanics and physics. Women learn all sorts of domestic work, and can read and write as well as their white sisters in similar circumstances.

As a race the aborigines are polite, proper in their behaviour, modest, unassuming, gay, fond of jokes and laughter, and skilful mimics. Even in rough horse-play they seldom lose their temper. Some possess a fund of humour. They are by nature frank, open and confiding, of a lively disposition, and cheerful under all sorts of privation; sometimes they show great delicacy of feeling. In many things the aboriginal is scrupulously honest; and his morality, according to his lights and teaching, is as high as among the generality of uneducated white people. Inter-tribal etiquette is punctilious, and breaches of it lead to fighting. Many aboriginals show great courage.

W.R.S.

Organization. Though Ridley and others did valuable pioneer work, the first serious attempt to study Australian tribal organization in detail was made by Fison and Howitt, whose *Kamilaroi and Kurnai* may be regarded as having laid the foundation of our knowledge of Australian anthropology. In this they demonstrated the existence of (1) two primary exogamous moieties, (2) classes into which the moieties were divided, and (3) totemic groups. In the case of the Kamilroi, the organization of a typical Australian tribe was adequately set forth for the first time, and it was shown that the so-called 'terms of relationship' were, fundamentally, group and not individual terms.

As might be expected, organization varies greatly in tribes inhabiting different parts of the continent. Speaking generally, it may be said that every tribe is divided into two moieties; this is the fundamental feature. Each of these is usually divided into two classes, and these may be further divided into sub-classes, so that in the most highly developed normal tribes we have two moieties with four sub-classes in each; further, different names are applied to the corresponding male and female sub-classes. This organization governs kinship; and as, with its associated terms of relationship, it refers to the whole tribe and to every member of the tribe, so each individual has a kinship or relationship term that he applies to every member of his own tribe—and to members of other tribes if they happen to visit his camp or if he goes to theirs, as may often happen during the performance of important ceremonies. In some (but very few) cases there are terms applied to single individuals; these, however, are rarely met with, and it is only by realizing the fact that the group, and not the individual, lies at the basis of tribal organization that this organization, as well as their habits, customs, and beliefs, can be understood. For example, in the Pitta Pitta tribe (Queensland) a woman calls her actual mother 'umma,' but applies the same name to each member of the group of women any of whom her father might lawfully have married; a man calls his actual wife or wives 'nopa,' but applies the same term to each member of the group any of whom he might lawfully have married; and so on right through the whole series of terms. Further, the group relationship shows out strongly during the performance of all their ceremonies, and even in camp life. There are, for example, men of a certain group who may lawfully marry women of another group. If the father of one of his eligible wives dies, though the man may never have seen father or daughter, it is still his duty to cut himself in the same way as if his actual wife's father had died. So again, if he catches a wallaby, should there be any man in camp whose daughter he might lawfully marry, he must give food to that man even if he has no daughter. The affairs of any individual are, at bottom, mainly concerned with the group of which he is a member; the family enters to a slight, but only a very slight, extent. During the very large, and by far the most important, part of his life when he is associated with his fellow

tribesmen (and often tribeswomen also) in the performance of the multifarious ceremonies that occupy so much of his time and thought, the group is predominant, the family is unrecognized.

The following examples are representative of the main features in regard to tribal organization—though of course only salient points are noted. Taking Australian tribes as a whole, we may divide them into five groups:—

(1) Those with two moieties and no class names. In all of these descent is counted in the maternal line.

(2) Those in which each moiety is divided into two classes and in which descent is counted in the indirect maternal line.

(3) Those in which each moiety is divided into two classes or four sub-classes, and in which descent is counted in the indirect paternal line.

(4) Those in which each moiety is divided into two classes, and in which descent is counted in the direct paternal line.

(5) Tribes that may be regarded as abnormal, inhabiting coastal areas in certain parts (such as Victoria and the Northern Territory) in which, if any class organization were ever present, it has been modified or superseded by some form of local organization.

(1) *Tribes with two moieties, but no classes.* These are chiefly met with in the interior of the continent and probably represent the most primitive form of organization; but, though there are no class names, there are groups of individuals standing in definite relationships to one another, who correspond to the groups of individuals to whom class and sub-class names are given in other tribes. In some cases the moiety names are Kararu and Matteri, in others Mukwara and Kilpara, in others Kumite and Kroki, or variants of these. Of these tribes the Dieri is an example. A Kararu man marries a Matteri woman and their children are Matteri: a Matteri man marries a Kararu woman and their children are Kararu.

(2) *Tribes in which the moieties are divided into two classes, and descent is counted in the indirect maternal line.* These can be illustrated by two examples. (a) the organization of the Pitta Pitta, which is typical of that of many central Queensland tribes, may be represented thus:—

1	2	3	4
Utaru.	Pakuta.	Children.	Children.
Kupuru Wungko	Kurkilla Bunburi	Bunburi Kurkilla	Wungko Kupuru

The two moieties are Utaru and Pakuta, each of which has two classes. The system as shown in this and all following tables is, that men of column 1 marry women of column 2, and their children are shown in column 3. Men of column 2 marry women of column 1, and their children are as shown in column 4. It will be seen that a woman's children belong to her moiety, but not to her class; in other words, we have direct maternal descent of the moiety and indirect of the class. (*b*) The organization of the Kamilroi, which represents that of many tribes in the interior of New South Wales and Queensland, agrees fundamentally with the Pitta Pitta, but has distinct names for males and females, thus:—

1	2	3	4
Kupathin.	Dilbi.	Children.	Children.
Ipai (Ipatha) Kumbo (Butha)	Kubi (Kubitha) Murri (Matha)	Murri (Matha) Kubi (Kubitha)	Kumbo (Butha) Ipai (Ipatha)

Descent is counted in the indirect female line, so far as the class is concerned; but, in addition to the ordinary marriage, it is permissible for a man to marry a woman belonging to the same moiety as himself, but to another totemic group. So far as the class name is concerned, the children take the one they would have taken had their mother married the correct man. It may be noted that in all tribes, when an irregular marriage is permitted, the children take the class appropriate to the normal marriage of the woman.

(3) *Tribes in which the moieties are divided into two classes or four sub-classes, and in which descent is counted in the indirect paternal line.* These tribes occupy a very large area in the centre and northern parts of the continent, and extend right across into Western Australia; at all events, they stretch beyond the far western end of the Macdonnell Ranges, and are met with again on the western coast. The Arunta, Karriara, and Warramunga may be taken as types. The Arunta organization in the southern part of the tribe is thus:—

1	2	3	4
Moiety 1.	Moiety 2.	Children.	Children.
Panunga Bulthara	Purula Kumara	Bulthara Panunga	Kumara Purula

In the southern part of the tribe there are only four class names; but as a matter of fact each of these is divided into two groups. The Panunga and Purula, two intermarrying groups, can be arranged as follows, using the letters *a* and *b* to indicate the two groups:—

Panunga *a* marries Purula *a*, children are Bulthara *b*.

Panunga *b* marries Purula *b*, children are Bulthara *a*.

A Panunga *a* man calls Purula *a* women *Unawa*, Panunga *b* men *Ipmunna*, and Purula *b* women *Unkulla*. The Unawa women are eligible as wives; under normal conditions the Unkulla are not. In the northern part of the tribe distinct names are given to the groups, which now form what are called eight sub-classes; as said before, these are always functionally present. The names and marriage arrangements are as follows:—Uknaria is the equivalent of Panunga *b*, Appungerta of Bulthara *b*, Ungalla of Purula *b* and Umbitchana of Kumara *b*.

1	2	3	4
Moiety 1.	Moiety 2.	Children.	Children.
Panunga Uknaria Bulthara Appungerta	Purula Ungalla Kumara Umbitchana	Appungerta Bulthara Uknaria Panunga	Kumara Umbitchana Purula Ungalla

The organization of the Kaitish, Warramunga, and other tribes in the northern central area, as far as the Katherine River in the north, and eastwards towards the Gulf of Carpentaria, is fundamentally the same, with different names for sub-classes and, in many, distinct names for the corresponding women's sub-classes, giving thus sixteen sub-class names in all. This feature exists also in the East Kimberley tribes in Western Australia. For example, among the Warramunga the equivalent of the Uknaria men are called Tjunguri, and the women of the same group Namigilli. In some tribes also the moiety names are retained.

Among the Warramunga the equivalent of moiety 1 in the Arunta is called Uluuru, and that of moiety 2 Kingilli. In the Karriara tribe in Western Australia the moiety names are lost, four classes are present, and the marriage arrangements are as follows:—

1	2	3	4
Moiety 1.	Moiety 2.	Children.	Children.
Banaka Paljari	Boorong Kalmera	Paljari Banaka	Kalmera Boorong

It will be seen that, except for the class names, the arrangement is identical with that of the southern Arunta; and a similar organization is evidently widely spread in Western Australia.

(4) *Tribes in which each moiety is divided into two classes, and in which descent is counted in the direct paternal line, so far as the class name is concerned.* The Mara tribe, inhabiting country on the Gulf of Carpentaria between the Roper and Macarthur Rivers, may be taken as a type. The arrangement is as follows:—

1	2	3	4
Moiety 1. (Mburi)	Moiety 2. (Umbaua)	Children.	Children.
Murungun *a* Murungun *b* Mumbali *a* Mumbali *b*	Purdal *a* Kulal *b* Kulal *a* Purdal *b*	Murungun *b* Murungun *a* Mumbali *b* Mumbali *a*	Purdal *b* Kulal *a* Kulal *b* Purdal *a*

There are four classes; but each of these, though there is no actual name for them, is divided into two, distinguished by the letters *a* and *b*. The arrangement has the appearance of being very definitely thought out, and there is, further, a very definite scheme, by means of which the divisions (Murungun *a*, *b*, etc.) are made to fit in with the corresponding sub-classes in other tribes with whom the Mara constantly come into contact.

(5) *Abnormal tribes in which class organization has apparently been superseded by some form of local organization.* As an example of these we may take the Kurnai tribe which, many years ago, occupied the mountains in eastern Victoria. It was divided into five groups, named after the localities in which they lived. There was no class organization, and a man could not marry a woman of his own local group. There were intermarrying local groups, marriage being by elopement. The Kakadu and allied tribes, living at the other extremity of the continent on the Coburg Peninsula and Alligator Rivers, have apparently no class organization, and the totem does not regulate marriage. The tribe is divided into local groups, and a man of one local group takes a wife from another particular group, the children passing into that of the father.

W.B.S.

Totemic Systems and Totemism. In dealing with Australian tribes the word 'totem' has been applied in at least three different senses: (1) the *Group totem*, that is, the material object giving its name to a group of individuals who commonly believe themselves to be descended from it. The name of the totem usually, but not always, passes by inheritance from generation to generation, sometimes in the maternal, sometimes in the paternal line; (2) the *Sex totem*, discovered by Dr. Howitt in the Kurnai and Wotjoballuk tribes in Victoria, where it exists side by side with the group totem. The women have one animal, such as the owlet nightjar, associated with them and the man another, such as the bat. This is of rare occurrence, and it may be doubted whether it should, strictly speaking, be regarded as totemic; (3) the *Individual totem*, usually acquired by dreaming of some animal. This also is of rare occurrence, and doubtfully totemic in the strict sense of the term. So far as Australia is concerned, it is advisable to restrict the term 'totem' to the first of these, and to define it as a material object (*a*) which gives its name to a group of individuals and (*b*) the name of which is usually hereditary either in the maternal or paternal line; and to restrict the term 'totemism' to a system based on the recognition of these two factors. It must be remembered that there are very considerable variations in regard to totemic customs and beliefs in different tribes.

In Australia totemism may be dealt with under three aspects, social, ceremonial, and magical. By the 'social' aspect is meant the division of the tribe into totem groups, their influence, if any, on marriage, and the mode in which each individual becomes associated with any one of them. Most tribes are, as aforesaid, divided into moieties, and these into classes. As a general rule, the totemic groups are distributed between the two moieties in such a way that each group is confined to one or other of them. The following tribes from different parts of the continent are typical of the more important variations in regard to the social aspect. (1) The Dieri are representative of tribes in which the moieties are not divided into classes. These moieties are called Kararu and Matteri, and the totem groups are divided between them. Kararu has rain, carpet-snake, crow, frog, etc., Matteri has cormorant, emu, eagle, hawk, native cat, etc. A Kararu man must marry a Matteri woman, but is not restricted in his choice to any one totem group. The children follow the mother's totem. (2) The Kamilroi are representative of a large number of tribes occupying a vast area of country in the interior of New South Wales and Queensland. The totems are divided between the moieties and the children take the mother's totem. (3) The Arunta are representative of an important group, including the Arunta, Ilpirra, Unmatjera, and Kaitish tribes. There are four classes or eight sub-classes, and the totem groups are not restricted to the moieties. Each group is, however, always more largely represented in one moiety than the other. Marriage between individuals of the same totemic name is not forbidden, but rarely takes place. The country occupied by the Arunta is dotted over with special spots inhabited by the spirits of old totemic ancestors, who enter women and undergo reincarnation. The traditions are very precise in re-

gard to these totemic centres so that the natives —knowing, or thinking they do, where any particular spirit-child entered a woman—are able to assign its totem to it. In the Kaitish, the most northern of these tribes, the totemic groups are more nearly divided between the moieties than in the Arunta. A man very rarely marries a woman of his own totem, and there is a strong tendency for the descent of the totem to be in the male line, as is always the case in regard to the class names. Each individual is normally associated with one totem group. (4) The Warramunga are representative of the Warramunga, Tjingilli, and other tribes occupying a large area in the centre, and extending across to the Queensland border. The totem groups are strictly divided between the moieties. A man may marry a woman of any totem in the moiety to which he does not belong, provided she belongs to the right class. Strict paternal descent of the totem is nearly, but not quite, the rule, but every child belongs to a totem group in his father's moiety. For example, a black snake man's children are almost always black snake; in rare cases one of them may belong to another totem group. As the moieties are exogamous, it follows that the totems are the same. (5) The Binbinga are representative of a group of tribes that occupy the country drained by the McArthur River. Their organization is closely similar to that of the Warramunga, but in these tribes not only are the totem groups divided between the moieties, but the descent of the totem name is strictly in the father's line. (6) Among the Kurnai in Victoria and the Kakadu on the northern coast-line there is no class system, and marriage is regulated by the existence of local intermarrying groups. In the Kakadu each spirit-individual has a double nature; one part enters the woman, one part remains outside. It chooses its own totem, and the spirit-part that remains outside tells the father the totem name of the child.

The ceremonial aspect has probably been very strongly developed throughout Australia, though it has only been studied in detail during recent years, when, unfortunately, in the whole of Victoria and New South Wales and in most parts of Queensland the tribes have become decadent. One of the earliest accounts that we have of the natives—that given by Collins in 1798—evidently describes a totemic ceremony. Speaking generally, it may be said that every totemic group has certain ceremonies associated with it, and that these refer to old totemic ancestors. In all tribes they form part of a secret ritual in which only initiated men take part. In most tribes a certain number are shown to youths during the early stages of initiation, but at a later period they see many more. In the Arunta, for example, the final stage is concerned with the Engwura, and this may extend over a period of three months, during which totemic ceremonies are enacted daily. To start an Engwura, the leader of some totemic group, after consultation with those of others, sends out a messenger called Ilchinkinja, which means 'the beckoning hand.' He carries a churinga (that is, a flat wooden slab commonly known as a bull-roarer), and passes over the country delivering his message at different camps. Slowly the natives gather together at the chosen place, where a special ceremonial ground has been prepared. The Panunga-Bulthara camp together, as do the Purula-Kumara, the division of the tribe into two moieties being very marked during the Engwura. Large numbers of churinga are brought in and stored on two platforms far from one another. These are associated with the old ancestors and their living representatives; and at times the old men call some of the younger ones together, rub the sticks with red ochre and tell their pupils all about the ancestors. Each ceremony is concerned with an ancestor, and is the property of some old man who either performs it himself or invites a younger man to do so. After the performance its meaning is explained. A characteristic feature of these ceremonies, the exact nature of which varies much in different parts of the continent, is that one or more men have bodies decorated with a design especially associated with the ceremony. Even more elaborate designs may sometimes be drawn on the ground.

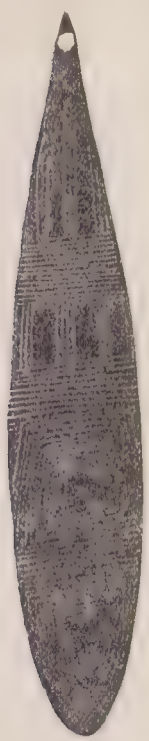
As for the magical aspect, in early days Grey (who used the Western Australian word Kobong for totem) stated that 'A certain mysterious connection exists between a family and its kobong, so that a member will never kill an animal of the species to which his kobong belongs, should he find it asleep; indeed, he always kills it reluctantly, and never without affording it a chance to escape. This arises from the family belief that some one individual of the species is their nearest friend, to kill whom would be a great crime and carefully to be avoided.' This idea of a close association between an individual and his totem is widely spread, but the exact beliefs and customs in regard to them differ very much in different parts. The general idea may be summed up in a remark made by a 'kangaroo' man, who, when looking at his photograph, said 'That is just the same as me, so is a kangaroo.' In some tribes there is a feeling of mutual protection between an individual and his totem, but this is not often met with. They are of the same flesh, and the belief in the descent from the totemic animal is widespread. In some tribes the individual will not kill his totem, but in most there is no objection to his doing so and handing it to others to eat. In some he will both kill and eat it. Speaking generally, the magical aspect of totemism appears to be largely associated with climatic conditions, so far as they affect the supply of food and water. Three typical examples of ceremonies will serve to show the nature of the magical aspect. In the Urabunna tribe, which counts descent in the female line, the ceremony is called Pitjinta. In a 'snake' group the decorated performer kneels down and extends his arms. The skin on each forearm is then pinched up, and he pierces it with a pointed bone.

When snakes become plentiful, men who do not belong to that totem group bring some to the old man and say, 'Look, here are snakes.' He smears a little fat over his arms and the bone, and tells the men to eat the rest. The bones are wrapped in the hair of a 'snake' man and put away. Among the Arunta the ceremonies are called Intichiuma. In that of a 'grub' group the men of the totem fasting, devoid of arms and ornaments, and characteristically marked, go in silence to a cave in which a large stone represents the adult insect and smaller ones its eggs; here they chant refrains, the burden of which is an invitation to the insect to come and lay eggs. Further ceremonies are performed in a long bough hut, supposed to represent the chrysalis case, built for the purpose near the camp. Some time later, when the grub is plentiful, they collect large numbers, return to camp and cook them. The head man eats a few, gives some to a few of the older men, and hands all the rest to those who do not belong to the group, telling them to eat it. The 'grub' men are not absolutely forbidden to eat, but do so sparingly. In the Kakadu tribe,

in the far north, there is a ceremony called Muraian that is evidently of the same nature—though it is not so detailed, owing, doubtless, to the normal abundance of food in this part. The natives have a large number of sacred sticks and stones, each supposed to represent a totemic animal or plant, which may only be seen by the elder men. During the ceremony they are grasped in the hands of men who dance round and round a central figure, stretching out the symbolic objects and yelling 'Brau, brau,' which means 'Give, give.' It sounds almost like a command to the totemic object. In Western Australia also, in the East Pilbara tribe, there are certain local totem centres (called Thalu) where ceremonies for the increase of the totemic object are held; in these women and children take some share—an abnormal usage. In many tribes the natives firmly believe that by means of magical ceremonies such as these they can control their food supplies. This belief was probably at one time widespread in Australia.

W.B.S.

Initiation. In all Australian tribes special ceremonies of an important nature, which vary much in detail, attend both the initiation of youths to the status of men and that of girls to the status of women. In the case of the youth, initiation is associated with showing him the 'bull-roarer' for the first time. In different parts it is called churinga, tundun, kunapippi, etc.—but its form is constant. It is a slab of wood (or, more rarely, of stone) pierced at one end. Through this hole a string is passed, and by this it is whirled round and round, making a noise supposed by women and children to be the voice of a great spirit that takes the youth away and initiates him. It is very difficult to understand the wide divergence in the initiation ceremonies of different groups of tribes. We have, generally speaking, three main types—(1) the knocking out of an incisor tooth, as amongst the Kurnai in the south-east; (2) circumcision (followed in many, but by no means all, cases by sub-incision) amongst tribes occupying a vast area in the interior of New South Wales and Queensland, the whole of the central area, and probably a large part of Western Australia; (3) special ceremonies amongst groups of tribes, such as those on Melville and Bathurst Islands and the Kakadu nation on the Alligator rivers, amongst whom no mutilation of the body (other than, perhaps, the pulling out of hairs) takes place.



Bull-roarer.

The Kurnai type is of historic interest, because in connection with it the first adequate account of initiation was given by Howitt, who also drew attention for the first time to the importance of the bull-roarer. Its essential parts are (1) the summoning of the tribesmen with a tundun, which may take months; (2) the assembling of candidates among the women on a specially cleared space, the bunan; (3) the assemblage of the men in a bush-house containing figures of totems and of Daramulun, who is regarded as the great father of the tribe; (4) the actual initiation, beginning with instruction of the candidates in tribal legends and laws, after which the women are scared away with a bull-roarer, the youths are taken to the bush-house, and on returning have the left upper incisor knocked out. Further instruction follows, and the initiated youths, now independent of the women, run off into the bush.

In the second type (including the tribes of central Australia and many Queensland tribes) there is a succession of initiation ceremonies taking place at various ages. The Arunta may be taken as a specimen. There is (1) painting the young boys and throwing them in the air, (2) the ceremony of Lartna or circumcision, (3) that of Arilthа or sub-incision, and (4) the Engwura. In connection with the second, the youths are shown the bull-roarer for the first time. In connection with both (2) and (3) they are shown sacred totemic ceremonies, and instructed in the laws, totemic history of the tribe, food restrictions and their duties as men; they are told that they must implicitly obey the old men; must not eat forbidden foods, but may supply other men with them; and on no account must they talk to lubras about what they have seen. Everything is made as impressive as possible, and the fact that the main ceremonies take place during the night, or just at daybreak, adds to the feeling of mystery. The boys have special designs painted on them, may not speak to any one save the old men in charge of them, are given very little food to eat, and pass through sundry other experiences, including being lain on by four to ten men, circumcision, and at a later stage sub-incision (Arilthа). The final ceremony, called Engwura, may be delayed until the candidate is 25 or 30 years old. After it he becomes as 'ertwa mura oknira'—very good man; but, since every man must pass through all the ceremonies, all the elder men are good, so that there are in addition grades of goodness. Those who are insufficiently interested in the ceremonies, and are given to chattering like women, are called 'irkun oknira' that is, light and frivolous. Others take matters seriously, and will, as they grow older, become leaders or 'oknirabata'—great teachers. Special status-names are applied to the boy, youth and man at the time stated:—Ambaquerka at the time of growing up, Ulpmerka after this and until circumcision, Wurtja during the ceremony, Arakurta after the ceremony and until that of sub-incision, Ertwakurka after this and until the Engwura, Uliara after the latter. As in the Kurnai, so in all tribes, women take an active part in the opening ceremonies, but are rigidly excluded from the essential parts when a bull-roarer is used. Usually some special ceremony symbolizes the fact that the boy is being withdrawn from the ranks of the women. For women, too, there are special initiatory ceremonies, in many ways analogous to those of the men. Fuller accounts of all these ceremonies will be found in the books by Howitt, Roth, and Spencer and Gillen, named at the end of this article.

The third type includes various coastal tribes, evidently much modified. A characteristic group of these inhabits the Coburg Peninsula, the Alligator River district and the coast as far as Darwin; a still more modified group inhabits Melville and Bathurst Islands. The former have a remarkable series of totemic initiation ceremonies; there is no knocking-out of teeth, and no mutilation of the body, except the pulling out of hair.

Among the Kakadu totemic ceremonies are shown to the novices on a special ground called 'ober.' There are various grades, the last of which (Muraian) is not passed through until a man is old. Among the Kakadu apparently no bull-roarers are used; but among the Larakia, at Darwin, at one stage three or four old men suddenly emerge from the bush and whirl them in front of the novices. At other stages the novices are subjected to rough treatment, such even as being kicked and hit hard, but they must not grumble or find fault. On Melville Island the novices are shown a special ceremony; the whole tribe is assembled in a camp, ceremonies are performed, and the yams cooked and eaten in a special way. The novices are also taken to a waterhole, where those who are passing through for the first time have their heads placed in bark baskets and dipped under the water, while those who have reached the second stage are caught hold of by the arms and legs and pulled violently backwards and forwards through the water. Amongst these tribes girls of corresponding status to the youths are specially decorated and take part in the ceremonies.

All the types of initiation ceremonies for men agree in certain fundamental points:—(1) They begin at the age of puberty. (2) During the initial ceremonies women play an important part. (3) During the essential parts women are absent; the youths are shown the bull-roarer, have the secret beliefs explained to them, and are instructed in the moral precepts and customs (including food restrictions) that they must henceforth observe under severe penalties. (4) At the close of the first part of the ceremonies (knocking out teeth, circumcision, etc.) a definite performance is enacted, emblematic of the fact that the youths have passed out of the control of the women. (5) The last grade is not passed through until a man is quite mature. W.B.S.

Beliefs. The belief in reincarnation is firmly held by all tribes, from the Urabunna in the south right across the continent to those inhabiting the Coburg Peninsula. The Arunta believe that in far past times their ancestors (who were endowed with powers much superior to those of their living representatives) wandered across that country in groups, 'kangaroo' men and women in one, 'witchetty grub' people in another, 'emu' people in another, and so on; the track followed by each group is well known. Where they halted, some went into the ground, their spirit parts remaining above, each in company with a churinga. The whole Arunta country is thus dotted over with local centres—one haunted by kangaroo, another by grub spirits, and so on. At the present day these spirit children are continually undergoing reincarnation. Each spirit has another associated with it, called Arumburinga, which is its double and always remains outside, living at the old camping-ground of the spirit when the latter is reincarnated. Many of the most important ancestors are known by name, and the old men decide whether a child is the reincarnation of any particular one; in that case the child bears his or her name. This name, however, is not used in public; it is secret, and known only to the old men of the totemic group. The woman never knows it, the man only when he is fully grown, and it is never mentioned except in whispers. When a child is born, one or two of the old men actually go out in search of the churinga. Sometimes they find it; sometimes they do not—in which event they make a new one, so that each individual is represented by his or her churinga in the local storehouse, called Ertnatulunga. A woman going near one of these places is always liable to be entered by a spirit child. Whenever a native dies, his spirit goes back to its old camping-ground, and remains there until it chooses to be reincarnated.

In Queensland the Tully River blacks believed that children result from one or other of four causes—(1) a woman sits over a fire on which she has roasted a piece of fish that has been given to her by her husband; (2) she goes out hunting and catches a special bull-frog; (3) some man tells her to have a child; or (4) she dreams that a child has gone inside her. The Cape Bedford blacks believe that spirit children enter the mother in the form of a curlew, if they be girls, and in that of a snake, if boys. If they hear the curlew whistling at night they say 'Hallo, there is a child about.' According to the Pennefather natives, a mythic being called Anjea makes children out of swamp mud and puts them in the mothers. He is never seen, but can be heard laughing in the scrub. In the Warramunga tribe, each totemic group is supposed to have had one great ancestor who wandered over the country, performing ceremonies at different spots, where he left spirit children behind; it is these who are born again. In the Gnanji tribe there is the same belief; but, in addition, if a man travels, spirit children from his own place may follow him up and go inside his wife.

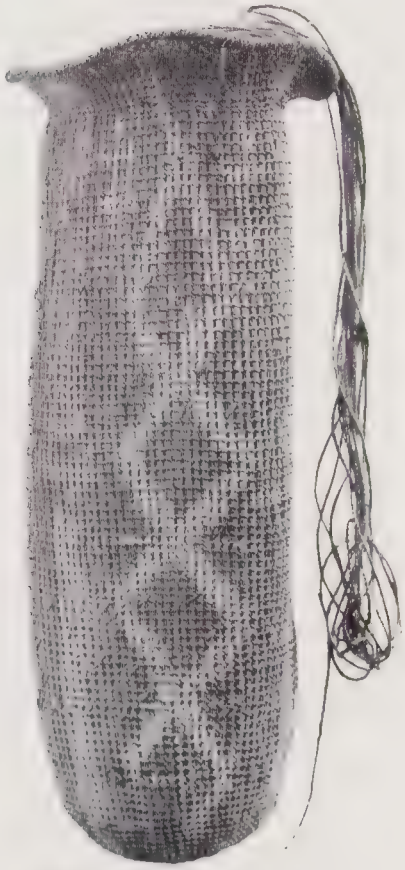
In the Kakadu tribe the beliefs are very precise and detailed. There are supposed to have been a limited number of ancestors, who deposited spirit children at different places. These have been continually undergoing reincarnation. The names of all are known, and every individual now bears the name of one of them. There is no secrecy in connection with this. When a man dies, the spirit part stays with his bones after the mourning ceremonies are over, forming what is called a Yalmuru. This gives off a double of itself, somewhat like the Arumburinga in the Arunta, but here called Iwaiyu. It is the latter that enters a woman and undergoes reincarnation. Later on again, the original Yalmuru, who watches over the man or woman during his or her lifetime, is supposed to become worn out, so that when the man dies the old Iwaiyu becomes the new Yalmuru, which in course of time produces a new Iwaiyu, and so on, generation after generation.

In the Broome district of Western Australia, the natives believe that every child must be 'dreamed' by his father, and the 'dream-baby' is called Ngargarula. If the latter does not appear to the father, and his wife gives birth to a child, he does not believe that the child belongs to him. If, on the other hand, a man is separated from his wife for a long time, and while he is away a Ngargarula comes to him and his wife has a child, he believes this belongs to him, no matter how long a time he may have been separated from his wife.

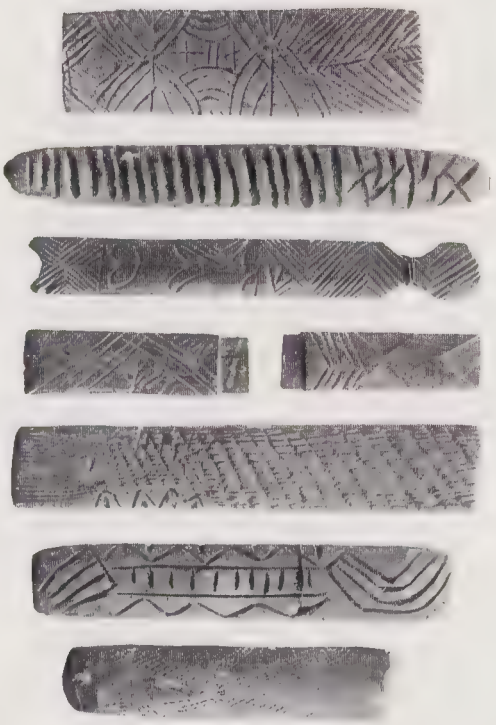
All over Australia, too, the natives appear to believe in beings endowed with powers superior to their own. In the Narrinyeri tribe in South Australia a being called Nurrundere was supposed to have made everything, and to have instituted their rites and ceremonies. The Wotjobalƚuk in Victoria spoke of Bunjil as 'our father,' and the Kulin people believed that he was an old man with two wives, who taught them the arts of life and divided the tribe into intermarrying groups. Among the Kurnai, Bunjil was a great being,

ABORIGINAL UTENSILS, ETC.

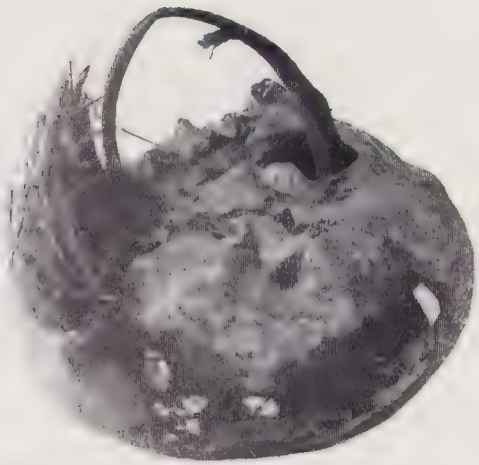
Plate III



Basket (Northern Territory)



Message-sticks (northern Queensland)



Bowl used as water-carrier (The Coorong, S.A.)

Basket (Barcoo River, Q.)

all knowledge of whom was confined to the men. The Kamilroi looked on Baiame as the being who created all things. Amongst the Yuin people Daramulun is supposed to have instituted the ceremonies and made the bull-roarer. He lived in the sky, watching the men. His name is only used by the initiated. In parts of Queensland they believe in Kohin who lives in the Milky Way, roams about at night as a warrior, killing all natives he meets, and is offended if they do not keep the customs. The Kabi and Wakka tribes believed in beings such as Biral, Jonjari and Dhakkan, who was identified with the rainbow and lived in deep waterholes. He could shatter mountains and slaughter natives, and was at times malignant. He substituted half-caste for pure-bred children—so he was called Warang (wicked).

In the central tribes there is everywhere a belief in the former existence of ancestors endowed with superior powers. But there are other superior beings. The Arunta believe that long ago there were two, called Ungambikula ('made out of nothing'). They lived in the sky, came down and made men and women, and then turned into lizards. The Arunta also believe in the existence of mischievous spirits, called Oruncha, who are always ready to injure natives; but they have no great spirit such as Baiame. They have a mythical being called Twanjirika, who is supposed by the women and children to take the boys away at initiation and provide them with new 'insides,' and whose voice is heard when the bull-roarer sounds. The men, however, tell the youths that the sound is made by the roarers. There is a belief amongst the Kaitish tribe in a being called Atnatu. He made himself, the stars are his wives, and he has plenty of sons and daughters. Long ago he was angry with his children, so he dropped them down on earth, and, with them, everything the natives now have. If he hears the bull-roarers he is pleased, if not he is angry. The Binbinga on the Gulf of Carpentaria believe that there are two malignant spirits called Mundagadji, anxious to hurt them, and a friendly one, named Ulurkura, who lives in the woods and stops the Mundagadji.

Speaking generally, it may be said that every tribe has a belief of some kind in superior beings; that, with rare exceptions, the latter are not supposed to take any personal interest in the natives or to be pleased or displeased with what they do; that no appeal for help is ever made to them; and that they have nothing whatever to do with the inculcation of moral precepts. W.B.S.

Magic, and Medicine Men. It is difficult to overstate the part that magic plays in a blackfellow's life. From the moment that he is born until he dies he lives in an atmosphere of magic. There are two sides to it, the evil and the good; the former bulks more largely in the blackfellow mind. Of good magic we have, on the one hand, ceremonies such as those in which a man of the 'yam' totem will take one of his yam churinga, 'sing' it and then deposit it on ground where yams are usually found, with the idea that he can thereby make them grow; on the other, we have magic called into existence to counteract evil magic. In some tribes any man, or even woman, may perform evil magic; in others the power is confined to the medicine men—as is also, in all tribes, the exercise of curative magic. Medicine men are made in various ways. Sometimes an old medicine man will initiate a young man; more often they are supposed to be made by supernatural beings of some kind; and in most, if not all, cases the medicine man has in his body something in the form of small crystals. These are the seat of his 'virtues,' and can be projected into the body of the patient, in whom they may either cause trouble or counteract evil magic implanted by some other individual. The medicine men also communicate with the spirits, and only they can withdraw 'poison bones and sticks.' They often fly into the sky during the night, visiting hostile camps and inserting bones and sticks into enemies. Sometimes by means of invisible ropes they climb up and down between earth and sky. Some are even strong enough to ward off evil magic from a whole tribe. At the time of the 1901 comet a powerful Kaitish medicine man saved the whole tribe from destruction by night after night 'singing' the comet's tail, and preventing the spears, of which it was made, from being hurled on to the Kaitish country.

The commonest form of evil magic is associated with pointing bones and sticks. A typical form (munguni) from Queensland may be taken as representative of this form. The instrument consists of a short pointed bone attached to a string that passes into and through a little hollow receptacle, made of bone or wood, and out at the opposite end, which is then closed. When in use, the receptacle is held in one hand and the bone pointed towards the victim, who may be miles away. A double action takes place; some of the victim's blood is drawn into the receptacle, where it is sealed up, and at the same time evil magic passes out into the victim. To kill the latter, the receptacle with its contents may be burned; just to keep him ill, it may be warmed every now and then. He will never recover until it has been thoroughly rinsed out.

Another characteristic form is associated with an object called tchintu. It is only a small lump of resin with two teeth in it, and a long string attached; but by being 'sung' the heat of the sun can be drawn into it, and then, if it be placed in the tracks of anyone, the heat follows the victim up, enters the body and kills him.

Some of the most potent forms of magic are associated with objects containing hair cut from the bodies of the dead. Used on avenging parties, they both endow the wearer with strength and accuracy of aim and at the same time render the victim powerless. Another favourite and widespread practice is that of 'taking the kidney fat.' This is usually done by a hostile medicine man. In the Wotjoballuk tribe he sneaks on the sleeping victim, carrying a magic bone with a noose attached to it. He may either project the bone into his victim—which action compels him to come out to the medicine man, who then throws him over his shoulder and carries him off—or, if in camp with his victim, may pass the bone under his knees when he is asleep, round his neck and through the noose, rendering him helpless. In any case the victim is unconscious of what takes place. The medicine man opens the right side of his victim just below the ribs, and abstracts the fat, which may be eaten or rubbed on weapons. The wound is 'sung' and the sides bitten together in such a way that no scar is left. The victim wanders back to camp, but soon dies. No medicine man can cure one whose kidney fat has been extracted; but he can determine—even the patient himself may —who is the guilty one. Any medicine man can withdraw bones and objects of magic generally, and is always called in when a patient is ill. No native believes in illness except as the result of evil magic, and magic from a distance is always potent. Pain is caused by some concrete thing

that must be removed from the body; the method of procedure is very much the same in all tribes. The patient lies down; the medicine man comes up and gazes fixedly upon him, as often as not projecting some magic crystals into him as an antidote. Then, after prolonged sucking and massage, he will, perhaps (but only if he be a very gifted practitioner), withdraw the poison-bone or stick whole; in most cases it is removed bit by bit. Then, unseen one by one, his magic crystals return to his body. W.B.S.

Burial Ceremonies. Death is always supposed to be due to evil magic, and may be brought about in various ways. Very often a bone or stick is 'sung' and pointed in the direction of the victim, whom its evil magic then enters. In some tribes a ceremony is performed with the object of catching the double of the man's spirit, without whose friendly guidance he meets with an accident. Death is always a source of fear to natives, because in many cases it means not only that there is some evil spirit or magic influence at work, but also that the spirit of the dead person is hovering about. It is customary to shift camp the moment a death occurs, and in almost all tribes special ceremonies must be carried out. These vary very much, as do the methods of dealing with the body, in which at least seven main types, with many variants, may be recognized. (1) *Simple earth burial.* This takes place in many tribes all over Australia, of whom the Arunta may be taken as a type. First of all, the deceased's hair is cut off and made into a special girdle, filled with magic, to be subsequently worn by a man who avenges the death. The body is buried in the ground in a sitting position, with the knees doubled up against the chin; the earth is piled up to make a low mound, with a depression on one side to allow of ingress and egress of the spirit. The camp is burnt down, and in the case of a woman everything is destroyed. No person may mention the deceased's name during the period of mourning; if any one does, the spirit hears, thinks they are not mourning properly, and is angry. In the case of a man, those who might legally be his sons-in-law neither mention the name, nor attend the funeral, nor take part in the ceremonies; but they must cut their shoulders. The actual widow or widows paint themselves with pipeclay, and are called inpirta ('whitened one'). They must not speak until, at a later period, a ceremony is performed to remove the ban of silence; this ceremony shows that the widow is about to resume her ordinary life, and later on she will become the wife of one of the younger brothers. At least a year after death the ceremony of urpmilchima (trampling the twigs on the grave) is performed. The widow smears herself over with pipe-clay and, wearing a chaplet made of clusters of small bones that hang down over her face, accompanies the other men and women first to her late husband's camp and then to the grave, which they approach yelling, so as to drive the spirit ahead and into the ground. After cutting and wailing, the chaplet is broken and buried in the grave, by the side of which the widow rubs the pipeclay off, and her mourning is over. The spirit sees that it has been properly mourned for, and returns to its ancestral home, where it lives until it undergoes reincarnation. The most elaborate earth burial occurs on Melville and Bathurst Islands; there very definite and highly decorated grave-posts are erected, around which the mourners dance. (2) *Burning the body.* This was carried out both in Victoria (Ovens River district) and New South Wales (near Sydney). The calcined bones were, in some cases, placed in the hollow branch of a tree. (3) *Burial on a tree platform.* This custom is widely spread. The Narrinyeri and Encounter Bay tribes of South Australia may be taken as examples. Among the former, the apertures of the body are sewn up and it is placed on a platform, under which a fire is lighted; the relatives sit beneath. In the latter the skin is scorched off by fires and sun, and then the remains are placed on a platform. (4) *Temporary burial on tree platform and subsequent disposal of bones.* The Warramunga (central Australia) is a typical example. Immediately after death the body is placed on a platform of boughs in a tree. When the bones are clean, they are all raked out, and the skull is smashed; then, with the exception of one arm-bone, they are buried in an ant-hill. The arm-bone is brought into camp, and handed over to the mother of the dead person. At the close of a ceremony connected with the totem of the deceased it is broken in two and buried in the ground. (5) *Eating the flesh, followed by platform- and subsequently coffin-burial.* This occurs amongst the Mara, Anuta, Binbinga, and other tribes on the western side of the Gulf of Carpentaria. The eating is strictly ceremonial. The bones are wrapped in bark and placed on a small platform. They are finally enclosed in a log coffin decorated with the totemic design of the deceased; this is placed either by the side of a water-hole, into which it is swept at flood-time, or in a cave amongst the rocks. (6) *Mummification.* This is met with chiefly in Queensland, the dried body being attached to a kind of small scaffold. (7) *Leaving the body in the open.* This occurs very rarely, as in the Yercla-mining tribe on the coast of the Australian Bight. W.B.S.

Manners and Customs. The task of gathering information regarding the manners and customs of aborigines is beset with difficulty. In the first place, a blackfellow desires to please, and will give the answer that he thinks his questioner wants. Secondly, his answer may be entirely misunderstood: for example, the name of a river may be stated on the authority of a blackfellow to be such and such, the word really meaning 'I don't understand.' Thirdly, both in regard to information supplied by the blackfellow and in regard to what an observer sees for himself, what is true for one tribe may be quite misleading when applied to another in close proximity. Writers are often right in what they affirm, but very apt to be wrong when they begin to deny.

The aboriginal is a wandering hunter, a gatherer of such things as Nature produces for him without any special foresight on his part or any effort except what is required for the capture or the search. He is not an agriculturist in any sense; 'settled agriculture' for the blackfellow in his native condition would have been impossible as a means of subsistence. Even when civilized and apparently domesticated, he has an intense and irresistible longing to 'go bush,' and becomes really ill if this homesickness is not satisfied. A blackfellow who can continue at laborious work for any length of time without growing bodily ill is a rare curiosity. The lack of domesticated animals is often instanced as evidence of the aboriginal's inability to domesticate animals. But where were the materials to work upon? Who that

knows Australian fauna can imagine any aboriginal endeavouring to plough with a kangaroo or trying to milk a wallaby? When horses were introduced, the blackfellow proved himself unsurpassed in the art of horsebreaking and managing all varieties of imported domestic animals. The men pass their time in hunting, fishing, fighting, and making arms and implements. The women gather and prepare food, make nets and bags, and attend to the children; on the march they are the camp-baggage carriers. A good idea of their relative occupations and duties may be gathered from Grey's accounts of their equipment:—

> The Australian hunter is thus equipped:—round his middle is wound, in many folds, a cord spun from the fur of the opossum, which forms a warm, soft and elastic belt of an inch in thickness, in which are stuck his hatchet, his kiley or boomerang, and a short heavy stick to throw at the smaller animals. His hatchet is so ingeniously placed, that the head of it rests exactly on the centre of his back, whilst its thin short handle descends along the back bone. In his hand he carries his throwing-stick, and several spears, headed in two or three different manners, so that they are equally adapted to war or the chase. A warm kangaroo skin cloak completes his equipment in the southern portions of the continent; but I have never seen a native with a cloak, any where to the north of 29° s. lat. . . . .
>
> The contents of a native woman's bag are:—A flat stone to pound roots with; earth to mix with the pounded roots; quartz, for the purpose of making spears and knives; stones for hatchets; prepared cakes of gum, to make and mend weapons, and implements; kangaroo sinews to make spears and to sew with; needles made of the shin bones of kangaroos, with which they sew their cloaks, bags, &c.; opossum hair to be spun into waist belts; shavings of kangaroo skins to polish spears, &c.; the shell of a species of muscle to cut hair, &c. with; native knives; a native hatchet; pipe clay; red ochre, or burnt clay; yellow ochre; a piece of paper bark to carry water in; waistbands, and spare ornaments; pieces of quartz, which the native doctors have extracted from their patients, and thus cured them from diseases; these they preserve as carefully as Europeans do relics. Banksia cones (small ones), or pieces of a dry white species of fungus, to kindle fire with rapidly, and to convey it from place to place; grease, if they can procure it from a whale, or from any other source; the spare weapons of their husbands, or the pieces of wood from which these are to be manufactured; the roots, &c. which they have collected during the day. Skins not yet prepared for cloaks are generally carried between the bag and the back, so as to form a sort of cushion for the bag to rest on. In general each woman carries a lighted fire stick, or brand, under her cloak and in her hand. (Grey's *Journals*, ii. 264-6.)

Aboriginal hunting is not a mere matter of endurance, speed, or accuracy of aim; it is observation brought to a fine art and acted upon. The blackfellow knows the track, cry, and habits of every animal, and takes advantage of its every peculiarity or characteristic to secure his prey. He will track the opossum by its claw-marks on a tree-trunk, or by observing the flight of mosquitoes if no claw-marks are visible. He will decoy pelicans within his reach by imitating the jumping of fish, throwing mussel shells or splashing the water with his fingers. Being almost amphibious in habit, he will creep or swim up to ducks with grass round his head, and pull the birds one by one under water, breaking their necks and letting them float till he has enough. He will find and capture snakes by watching the movements of their companions the butcher-birds. He will catch a bee, stick a piece of feather or down on it, let it go, and follow its flight until he finds its hive and honey. He will walk into the sea at a place where a white man cannot see a single shell, and in a few minutes, by digging in the spots of yielding sand with his feet or fingers, will find enough cockles for a meal; in short, he will find abundance and live at ease where a white man would see nothing and starve to death. His power of tracking is due to observation and not to instinct, although the process may be to some degree unconscious; a white man can learn the art without very much difficulty. His ingenuity is seen almost as much in fishing as in hunting. Hooks made of shells or tortoise-shell, harpoons, spears, baskets, cages, nets, hollow-log traps, weirs, dams, fences and poisoning are all employed as a means of obtaining fish. The remora or sucker-fish, with a string attached to its tail, is used as a guide to direct him to turtle, dugong, or other fish.

It often happens that one tribe wishes to pass into or through the country of another for the purpose of gathering food, or obtaining it or other necessaries by barter. On such occasions a very rigid etiquette is observed. A messenger is sent in advance, dressed elaborately in emu feathers or other recognized ornaments and bearing as credentials a message-stick somewhat larger than a finger, or a 'pass-it-on' cubical stone about three-quarters of an inch in size. Message-sticks are also used between members of the same tribe. While the subject has not been thoroughly investigated, and the markings on the sticks may have some meaning comparable to our written messages, it is now usually held that they have no significance apart from what may have been agreed on beforehand between sender and receiver. 'More than anything else' says Roth, 'the stick acts as a sort of guarantee of good faith, to show there is "no gammon," and may at times act as a safeguard or passport over otherwise hostile country; there is nothing on it in the form of a communication which can actually be read, the messenger invariably carrying the message by word of mouth.' It is known that a great system of trading and bartering exists, but it has been hardly investigated at all except by Roth in northern Queensland; one recognized trade-route involves nearly 500 miles of travel, but in most cases the tribes do not move far outside their own territories, acting rather as carriers of desired goods between natives on one side and on the other.

Their fighting customs are somewhat peculiar. One does not find one tribe carrying on a well-directed or continued war of extermination or of vengeance against another. The reasons for a fight are clearly recognizable, and its beginning, its form, and its end can all be predicted, whether it be between individuals or tribes. The rules or conditions of fights appear to be as definite as those of tournaments or duels.

The extremely complicated rules, varying with different sets of tribes, which dominate marriages among the aborigines are discussed fully in a previous section on *Organization*. The underlying principle appears to be prevention of in-and-in-breeding, but the proper distribution of the food-supply seems to be also involved in some cases. In some tribes there is a provision for the compulsory marriage of cousins—a man must marry his mother's elder brother's daughter; this is especially interesting in connection with the study of Fijian customs, which make marriage of the children of brother and

sister compulsory, that between the children of two brothers or of two sisters being prohibited. In Fiji the progeny of these compulsory unions is said to be exceptionally vigorous and fertile.

Allegations sometimes made that the aborigines lack morals and allow promiscuous intercourse are wholly mistaken. The penalties of adultery, incest (i.e. illicit relations between members of the same phratry, etc.), seduction of the immature, and so forth, are severe and may involve death; whatever they are, they are strictly enforced. Crimes against nature seem unknown.

The aboriginal child, like all children of uncivilized races, comes into the world very easily. The mother may be at her duties a few minutes after its birth, which is hardly an incident in the routine of the camp or the march. A blow on the head may terminate its existence, if its mother be young or if it be likely to encumber the parents. Women may bear as many as 15 children; the average is about five; but in many places only two of these would be reared. Twins occur. The future of female children is determined according to their relations to their husband and his relatives, not by their own parents. Childhood as a rule is a happy time. The blacks are fond of their children, and seldom beat or correct them. There are many games and amusements for them. Idiocy is uncommon; mania sometimes occurs. Deaf-mutes are often very intelligent, and express themselves intelligibly.

The Corroboree appears to be a universal institution. It is 'the medium through which the delights of poetry and the drama are enjoyed.' It is also the occasion for all sorts of festivities and enjoyments, gymnastic displays and competitions, displays of dress that do not interfere with displays of the figure, religious observances, and secret rites; and it is the tribal circuit court. Full and excellent descriptions of several kinds of corroboree will be found in books by Roth and Spencer and Gillen.

W.R.S.

Dwellings, Food-supply, etc. A blackfellow camping for the night usually makes, before darkness sets in, a break-wind of bark, boughs, or bushes on the side from which he expects the wind to blow during the night. His forecast is almost invariably correct: if there should be occasion to alter the three-foot high erection, he can do so in a few minutes. The camp forms a greater or less segment of a circle, the convexity exposed to the wind and the fire between the occupant and the open gap to leeward. It may be so completely hidden as to elude keen search. The bed is formed of green twigs, reeds or grass. Camps intended to be less temporary usually consist of bark huts open in front. In some places bark is used almost exclusively, and makes excellent huts, since it can be procured sometimes in slabs about twelve feet long and ten broad. Overhanging rocks, hollow trees and caves are sometimes used, but caves are not in much favour. When many natives happen to camp together, there are recognized rules and customs regarding the position and arrangement of the huts and the mode in which various parties pass to and fro in camp. All boys and uninitiated young men sleep at a distance from the huts of the adults. Each inmate or family has a separate fire, or several fires. Large common fires are not used in camps. At times and in some places there may be larger huts; but the general conditions of the country make the small temporary shelters serviceable if not imperative.

The aboriginal of the northern parts wears nothing, and has no desire to wear anything—though occasionally, as among the women of Melville and Bathurst Islands, more or less efficient aprons are worn. Even civilized blacks in the north, when alone, throw off their clothing; when they hear that a white man is coming along, they make a scramble for European dress. Among southern tribes kangaroo-rugs and skins of the opossum and wallaby form the chief or only articles of clothing; a single garment is worn, varying in size according to the season, and usually oblong in form. It is worn fur-side out over one shoulder, and fastened with a wooden pin in front, so as to leave the other shoulder bare and the arm free. In some places seaweed or rushes are made into clothing, and the rough fibrous material formed by the scum of the lakes, when dried on the beach in large flat pieces, is used as blankets. No head-covering is worn or used, except at times some green bushes or wet weeds.

The scarring of the skin so commonly found throughout the continent is usually considered as ornament. The fact that the scars of adults are replaced in children by painted imitations would seem to lend weight to the explanation. It is probable, however, that this scarring, in the male at least, did not originate as ornament or art. Among some tribes in the Northern Territory the scars in women have reference to the family history of the individual, and show the number and sex of the children and whether they are dead or alive; also they indicate other relationships and widowhood. In men they do not appear to have a similar significance, and it is remarkable that they occur on such positions in the body as would brace up the joints and prevent the looseness of tissues so apt to occur in well-fed individuals, and so detrimental to their fighting powers. In this respect the aborigines remind one of the Scythians and Nomades mentioned by Hippocrates, who produced similar scarring with a very definite object in view. This subject increases in importance when one takes into account the theory of the affinities of the Caucasian with the Australian.

The ornaments most commonly seen are brow decorations made of the lower incisor teeth of the kangaroo; broad fillets of string smeared with ochre; necklaces of fur spun or twisted into string, of short pieces of the stems of grass threaded together, or of shells threaded on string; tassels of the tips of the wild dog's tail; armlets of woven grass or strips of skin; belts of scores of yards of hair or of bark carved and coloured; and pieces of wood, bones, or feathers stuck through a hole in the septum of the nose. The practice of painting and anointing the body in connection with bellicose, funeral or joyous occasions may also be included. The native is fond of his decorations, and not a little vain when wearing them.

The variety of food is enormous, both from necessity and from choice. The dietary extends from clay to kangaroo, from nardoo to honey. Roth has catalogued and described 240 edible plants and 93 species of molluscs used by the aborigines of northern Queensland. When it is considered that many of these articles of food require special methods of preparation (some necessary in order to modify their poisonous properties), it will be understood that the blackfellow's knowledge of food and cookery

is of no mean order. In some places white clay, a great delicacy, is elaborately prepared and eaten, as is also the clay that forms the outside covering of ant-hills. Among articles of food used by the aboriginal, but not usually favoured by whites, are ants, grubs, caterpillars, moths, wasp-larvae, lizards, iguanas, frogs, rats, mice and snakes. The native is sometimes pitied for having to eat such things as grubs; as well might we commiserate an Englishman for eating oysters, or a Frenchman for eating frogs. Even white children of all classes will indulge in eating tree-grubs. The native, in fact, lives well. He is more of an epicure than a gourmand. He knows what every district produces, when the products are in season, and how he can obtain them; so the varying food-supply makes him a nomad.

From our point of view he is very wasteful. He kills immature animals, and even devours young birds in the egg. It is often said that he has no foresight in the provision of food. This is a mistake; he rarely leaves the gathering or catching of food until he is hungry. On journeys he husbands his provisions with the greatest care, and in some instances looks a long way ahead. The huge beds of cockle-shells —some about a mile long and some hundreds of yards across—with ovens of flat stones in situ, found among sandhills near the shore in certain districts testify to the enormous number of molluscs gathered and cooked; and inquiry shows that the preparation and preserving of this sort of food is quite an extensive industry in those parts.

In many parts of Australia the water problem is a serious one on account of the general lack of springs, and this fact has made the aboriginal an expert water-finder. By looking at certain rushes (or other vegetation) and noting the disposition of the ground he is able to tell where and at what depth water will be found, and sinks his waterhole accordingly. Further, he has such an intimate knowledge of every foot of country, that he knows where after a shower or on a dewy morning he will find water which he can collect and store in his water-bag. In some places shells (e.g. that of *Haliotis*) are used as drinking-dishes; in others, skulls may be similarly employed. Among the Narrinyeri tribe, which lived where water was at times very scarce, skulls with the sutures sealed up were used as water-containing and water-carrying vessels. It is doubtful if such a custom obtains in any other tribe in the world. In some parts large shells (e.g. that of *Melo*) are used for water-carrying. Very commonly water-bags are made of the skins of animals. In desert places the aboriginal is able to obtain water in quantity from the long lateral roots of the gum scrub, a good root yielding about two-thirds of a pint. The captain of H.M.S. *Beagle* records that the blacks about the Gulf of Carpentaria have accustomed themselves to drink salt water almost habitually, for lack of fresh. An artificial drink is made in some places by dissolving manna or gum in water. Various plants are used for sweetening drinks.

It does not appear that the aboriginal anywhere manufactures intoxicants. The use of pituri (pitcheri) as a narcotic is very general. Tribes will send messengers hundreds of miles to obtain by barter the parts of this plant which are prepared for chewing. It produces a voluptuous, dreamy sensation. Sometimes it is smoked in pipes. In some parts, at corroborees, the natives produce a condition of frenzy by chewing the leaves of the stinging tree. Sexual stimulants are not unknown. At Port Keats, in the Northern Territory, the men use an infusion of the leaves of a plant as a local application for this purpose. In the civilized state both men and women use tobacco universally, and some are much addicted to alcohol if they can obtain it. Others acquire the opium habit, and make opium pipes out of beer bottles.

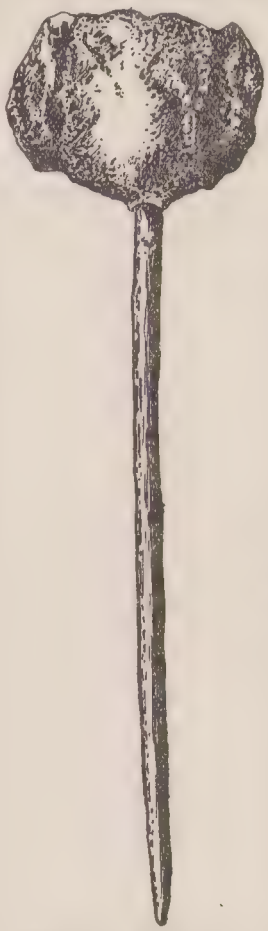
The subject of medicine is much bound up with magic, sorcery, witchcraft, and disenchantment. Nevertheless a fairly large amount of rational or empirical medicine is practised, consisting in the use of a few animal and vegetable preparations taken inwardly, and of liniments, lotions, resins, poultices, fomentations, heat, ashes, dust, ligatures, and such-like, applied externally. Bleeding is not uncommon as a general and local remedy. Fractures are treated by splints of wood or bark and by bandages, snake-bite in various ways—sucking the wound after applying ligatures to the limb being one of the commonest and most successful. The blackfellow has very little power of resistance against what may be termed 'medical diseases,' but recovers very quickly from all sorts of surgical injuries that would almost certainly prove fatal to Europeans under treatment. I have found skulls that obviously had been trepanned and had healed.

W.R.S.

Weapons and Implements. Amongst Australian stone weapons in actual use at the present time there are examples of the types known in Europe under the names Chellean, Mousterian, Aurignacian, etc. The terms eolithic, palaeolithic, and neolithic do not in Australia indicate either time-periods or levels of culture. Not only in different parts of Australia, but in the same parts, natives will use side by side implements that, if they were found in prehistoric deposits, would indicate different stages of prehistoric culture. Everything depends, in the main, on the material available. If the native lives in quartzite country, he makes chipped or flaked implements, some coarsely manufactured for temporary use, others carefully and often beautifully shaped. If he lives where he can get diorite, he grinds his tools; if he lives where he can get material suitable for both grinding and flaking, he makes tools which if found as 'fossils' would be called either palaeolithic or neolithic; the rougher ones, indeed, would be called eolithic (or rejected as non-human) by those who have never seen a native use a pebble that he has very roughly flaked to serve some temporary purpose. During ceremonies that require the cutting of a vein, a man will take from the ground any pebble that lies handy, and with another will strike off little flakes until he secures one with a sharp edge,

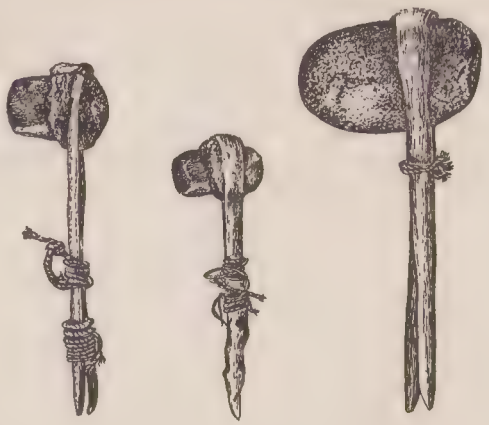
Quartzite knife, north-central Queensland.

and with this he will cut his vein open. At the present day, for example, a Warramunga man in central Australia possesses—and continually uses—a ground stone axe, a flaked or perhaps chipped and flaked axe or pick, a flaked knife hafted with resin (or with resin and wood), and, at the same time chipped stones quite as rude as—indeed, indistinguishable from—those of the old Tasmanians. It is this constant mixture of implements usually regarded as belonging to different levels of culture that forms the most striking feature of the present stone age in Australia. Without going into detail, the stone implements of the natives may be divided into three groups, according as they are used for cutting, grinding, or pounding. The cutting implements include axes, knives, adzes, and spear-heads. On the one hand, they vary in form from the crudest chip or pebble, roughly flaked on one side so as to form an axe, to delicate, leaf-like, jasper spear-heads, indistinguishable from those made by the most highly cultured neolithic people of Europe. On the other, they may be roughly chipped pebbles or blocks of stone, just showing the faintest trace of grinding, or beautifully ground and polished with a keen sharp-cutting edge. Only in very exceptional cases, however, is the whole surface ground. In some cases they were designed to be held in the hand, and show a well-marked finger grip, in others to be hafted with the aid of resin and wood. Grinding implements usually take the form of large kerns or mills, the nether stone being formed of a slab of sandstone hollowed out (often on both sides) with continuous grinding until the central crust becomes so thin that it breaks through. In some cases, as for grinding ochre, flat stones of any kind are used. Pounding implements take the form of lower stones or pestles, always with a pounding or husking hole, and of upper stones used as hammers. Outside these main groups we have such objects as playing-stones, sinkers attached to nets, etc.



Mounted Stone Axe, Western Australia.

The most characteristic weapon is the boomerang (q.v.). There are endless varieties of clubs and spears, all made of wood; the spears have barbs or blades of wood, bone, or stone. Most of them have a concavity at the handle end, into which fits the knob of a spear-thrower (wommera); but the very light cane ones, with simple sharp wooden points, as well as the great javelins of the Melville Islanders, are thrown by hand.

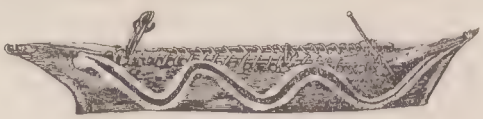


Mounted Stone Axes, Queensland.

The wommera is a very characteristic Australian weapon. Sometimes it is only a rounded stick two or three feet long, with a knob of resin at one end; sometimes it is leaf-shaped, either flat or decidedly concave, and is used for other purposes as well as throwing. Among the central and western tribes the weapon has a small wooden knob at one end, tied on with sinew, and at the handle end a lump of resin, into which is fixed a sharp cutting-flint. During ceremonies it serves to hold a supply of blood, down, or ochre; at other times it is used as an adze, gouge, or chisel. Altogether it forms one of the blackfellow's most useful implements.

Among other ingenious and useful implements are the wooden troughs (pitchis or coolamons) and baskets used for carrying food and water. The former are fashioned out of solid logs cut from gum-trees—or, when it is available, from soft wood such as that of the bean-tree. The perfect symmetry and shape of the hardwood troughs are wonderful, as is the regularity with which the concave lines made by the cutting-flint run parallel to one another along the length of the trough. Simpler baskets are made out of palm or pandanus leaves, the stalks ingeniously folded over; others are made from sheets of bark, stripped from a gum-tree during the wet season; others, again, are made of plaited grass or of string, so closely netted that the bags will hold fluid. The most remarkable baskets are undoubtedly those made in Queensland from split cane, with the two lower corners pointed and

Coolamon.



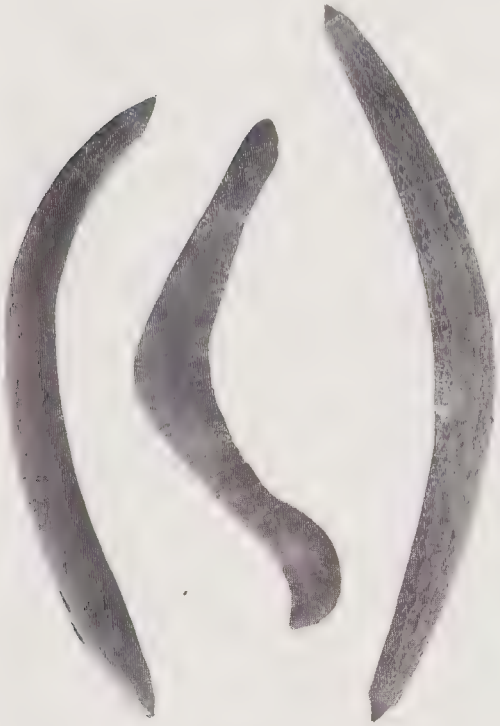
Boat-shaped Bark Water-carrier, northern Queensland.

ABORIGINAL WEAPONS

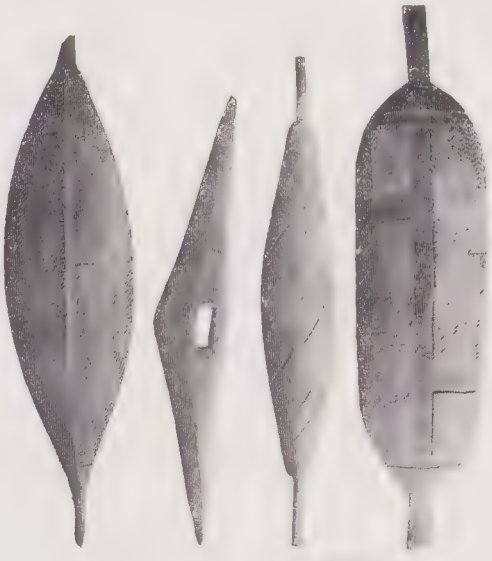
Plate IV

Stone-bladed fighting-pick (north-central Queensland)

Painted Shield (Cardwell, Q.)



Boomerangs



Shields (New South Wales)

upturned. Shields vary much; they may be of soft or hard wood, with handles carved out of the solid or inserted separately. For the most part they are broad, but in the south-east of the continent a narrow one was used to ward off the blows of clubs. The surface of the shield lends itself to decoration, which sometimes takes the form of incised patterns; more often, apart from the concave lines made by the flint, the design is due to pigment. Attention may be drawn to the massive shields with bold design found only in the Cairns and Cardwell districts of Queensland. The aboriginal is very clever at string-making. He uses human hair, fur of different animals, shredded leaves (such as those of the pandanus) or bark of different trees. He may use one hand to 'serve' the material and the other to rub it on his thigh, or may employ a very simple spindle. So admirably is the string made that at a casual glance it appears just the same as a white man's; it can usually be distinguished by the fact that native twine is very rarely more than two-ply, whereas the white man's is seldom less than three. It is used for various purposes, the most important, perhaps, being the making of nets and bags. Some of the larger fishing-nets measure 70 feet in length by 7 in width.

W.B.S.

Pygmy Flints. Since the year 1864, and especially since 1871, there have been many finds in various parts of the world of small manufactured stones, in length three-sixteenths of an inch, or less, and of varied forms. Various names have been given to them; they are now generally referred to as 'pygmy flints.' Very full monographs have been written on them by Coutil, Pittard, Montadon, and others, and speculation has been rife regarding their nature, uses, and anthropological significance. They have been classified according to their geometrical forms or their supposed uses. T. Whitelegge has made a large collection of specimens found near Sydney. He classifies these as surgical knives; barbed or death-spear flakes; double-edged knives; adzes or chisels; gouges; discoidal or button-shaped stones; single-edged knives; gravers; spear-scrapers; and (possibly) drills. It would be foreign to the purpose of this article to refer to the subject in any detail; the point of interest is that they have been found at various places in Australia (apparently not, so far, in Tasmania) and that in most if not in all respects the Australian specimens conform in character to specimens found elsewhere. This fact is very significant, when one considers that in all apparent essentials their structure remains constant in character from the earliest times, probably from the palaeolithic period.

Canoes are found among the lake and river tribes and on parts of the coast. They are commonly made of a large sheet of bark removed from a tree-trunk, and bent or shaped into form by heating. A large one, 20 feet long, to hold seven or eight people, can be made in a day. On some parts of the north coast there are wooden canoes with outriggers; in other parts catamarans are found, made of several logs of light wood tied together. W.R.S.

Decorative Art. The decorative art of the Australian aboriginal, so far as weapons and implements are concerned, is generally remarkable for the almost entire absence of design suggested by natural objects. In south-eastern Australia we meet with shields, etc., ornamented with conventionalized animal drawings, but they are so rare as to attract attention at once. In his rock and bark drawings the blackfellow will depict animals and plants; but, for the most part, his ornamentation of implements and sacred objects alike consists of conventional designs. Owing to lack of material, he is restricted to a few colours; red ochre, pipeclay, yellow ochre, and charcoal, are his four mainstays. Here and there he may have something like 'wad' (an oxide of manganese that gives a pearl-grey colour when powdered). No blue is ever used by the aboriginal in his native state, though he soon adopts it when in contact with white men.

A very striking feature is the use he makes of down, derived either from birds or from the involucral hairs of different plants. He mixes it with red ochre or pipeclay—never, curiously, with yellow. With the aid of such materials he produces simple, bold designs of circles, spirals, and symmetrically curved lines, showing an appreciation of strong contrasts, such as are offered by black or red circles, spiral and curved bands, outlined by white dots. So far as the nature of the design is concerned, they can be divided into three series—zoomorphs, phytomorphs, and geometrical. From another point of view, they may be divided into two series—ordinary and sacred. Of ordinary designs there are three well-marked methods of production. *Incision* by means of a sharp stone, tooth, bone, or shell. The simplest ornamentations have the form of finer or coarser groovings that run parallel to the length of the object. These do not necessarily give rise to a pattern. In olden days the tribes on the Murray River, and in various parts of the coastal districts of New South Wales and Victoria, made very elaborate shields with incised designs representing animals. Their spear-throwers were ornamented in the same way. Very characteristic, indeed, is the incised zig-zag pattern on Western Australian shields and spear-throwers. In some cases concentric squares are cut on weapons and corroboree tablets, and (more especially in New South Wales) trees near a grave are ornamented on one side or all round, for many feet from the ground, with deeply cut designs, some of which may be totemic in significance. Occasionally incised drawings of animals are made on rocks. *Burning* the surface with a fire-stick is not a frequent form of ornamentation, and is only used in the case of 'pointing sticks,' of which, in the central area, it is very characteristic. It takes the form of a series of spiral lines, circles, notches, or dots. *Painting* a surface with pigment is by far the most common method of ornamentation, and is applied to (1) weapons and implements, (2) human bodies, (3) rocks, bark, and the ground. In many tribes it is customary to coat almost every weapon with ochre. Boomerangs, shields, spears, dilly-bags, knives, and fighting clubs may have special designs. Attention may be drawn to the zig-zag designs of Western Australia, to the bold decorative schemes on the large Queensland shields, to the carefully drawn decoration of Queensland dilly-bags (where conventional designs are sometimes associated with zoomorphs), and to the very characteristic and effective designs on spears, throwing-sticks, grave-posts and large bark baskets of the Melville and Bathurst islanders. The latter differ from any on the mainland. The various designs indicate considerable variations in artistic skill, but all show that the native has a distinct feeling for decorative effect. Drawings on human bodies are done

in red and yellow ochre, pipeclay, and charcoal. In some cases the designs are merely what the natives call 'play-about,' but the more important are associated with the performance of corroborees; these, in almost all cases, are purely conventional designs of circles and lines that often follow the contour of the body. Each corroboree has its own design. Drawings on rocks and bark are among the most interesting, and vary much. They may be zoomorphic, phytomorphic, or purely conventional, though the first two are more common than the third. In one (zoomorphic) the spectator is supposed to be looking upwards from beneath an emu that is sitting on its eggs; in others we have drawings of wild dogs, kangaroos, and various animals; in others, of cycad fronds; while others are purely conventional concentric circles of lines and dots. The 'red hand,' about which so much has been written, has no special significance. It is met with everywhere, and is made by placing the hand on a rock or bark surface, and then silhouetting it by means of blowing red ochre on to the surface round it. Sometimes pipeclay or charcoal is used, in which case we get a white or black hand; but in no case—red, white, or black—has it any more significance than the outline of a fern made by a child spraying ink over the frond. In some cases, more especially on the northern coast-line, fairly elaborate drawings of animals and mythical objects are made on rocks or sheets of bark. The walls of rock-shelters are covered over with crude, but often suggestive, representations of the animals the natives feed upon—crocodiles, lizards, snakes, fishes, etc.—sometimes also with quaint drawings of gnomes that inhabit the mangrove swamps and rocky ranges. By far the most elaborate rock paintings, however, are those in the Kimberley district, first described by Sir George Grey. Their origin is a mystery, but it may be regarded as certain that they were not drawn by Australian aboriginals of the race known to us.

Sacred designs are often not distinguishable at first sight from some of those described above; in fact, so far as conventional drawings (such as concentric circles) are concerned, as much depends on the location of the drawing as on its nature. In one spot a drawing will be sacred, in another it will not; but, whilst this is so, yet, on the whole, the sacred designs are well defined. They are best known in the central and northern tribes, amongst whom they are very well developed. In the Arunta, for example, every totem group has its Ilkinia, or totem design, which the men of the totem group may paint on themselves. In addition to this, right through the tribes every separate totemic ceremony involves a special design, painted on the bodies of the performers, consisting of lines of red and white down that often cover closely the whole of the upper half of the body and face, and extend upwards on to an elaborate head-dress. In every instance the down is fixed on the body by blood drawn from the performers. Some totemic groups have in addition special designs drawn on rocks at places where churinga are stored and ceremonies are performed. No women go there. Others have ground drawings of a very elaborate kind, best exemplified by the Wollunqua snake totem in the Warramunga tribe. Two of these drawings will suffice. In one the sandy soil is smoothed down with water to make a firm flat surface, over which a coating of yellow ochre is spread; on this five series of concentric circles are drawn, representing trees and waterholes at the home of the Wollunqua—a sinuous band 18 feet long represents the snake itself, and footmarks by the side indicate those of an old man, its mate. The rest of the design consists of white spots of pipeclay that entirely surround the black bands. In the other a mound, 15 feet long and 18 inches high, is made and covered with dots of pipeclay that surround and outline a sinuous band of red ochre along each side, representing the snake. Ground designs similar in significance, associated with sacred ceremonies, exist (or once did) amongst many tribes on the eastern coast.

Some of the more elaborate designs are found on objects worn or carried by men performing sacred ceremonies. One such special object may be described, partly because it represents one of the most elaborate, partly because the significance of its different constituents gives a good idea of one side of the native mind. It is called 'waninga,' and is (or was) used in tribes round Lake Eyre, such as the Urabunna, and also among the southern Arunta. It is important to note that a waninga used in a kangaroo ceremony, for example, represents a kangaroo, while a similar one used in a rain ceremony represents rain and things associated with it. Take a rain waninga. A strong spear, 10 feet long, forms a central shaft; at right angles to its length, and at a distance of 2 feet from either end, are two sticks, each 3 feet long; between them, running parallel to the length of the spear, lines of human-hair-string are tightly strung. Each line takes a turn round the transverse bar at either end, slants away to the spear, turns round this and runs back to the bar, until the whole space between the bars is filled by close-set bands of string with a triangular-shaped patch at each end. A band, 1½ inches wide, running round about the same distance within the margin, is made of opossum-fur-string, whitened with pipeclay, the same width of string on the inside of it being red ochred. Tufts of the red-barred tail-feathers of the black cockatoo are tied to the tip of the spear and the ends of the bars. A number of bands of white down run in parallel lines across the strings. The man carrying the waninga wears wood-parings on his head, smeared in blood. The red string represents thunder; the white band, lightning; the ordinary black string, rain falling; the white down, clouds. Black cockatoo feathers are used because the call of these birds is always taken as an indication that there is a waterhole near. The red of the feathers and the blood-smeared wood-parings represent the masses of dirty-brown froth that float on flood-waters. This waninga is used during rain-making ceremonies, and serves as a good example not only of decorative art, but of the exercise of sympathetic magic.

W.B.S.

Destiny. In the early days the number of aboriginals diminished through quarrels with the settlers—the whites violating some aboriginal law, the blacks retaliating, or vice versa. For something that from a white man's point of view was a crime a whole tribe would, in official language, be 'dispersed;' and similar methods were employed unofficially. The aboriginal had little protection and no redress; it would have been better for him if he had been an uncompromising fighter, declining to have anything to do with his spoilers. Some scheme might then have been devised whereby his rights would have been recognized, and he would have been kept from contact with our civilization. Such

contact as has occurred, and now obtains, does not tend to absorb the blackfellow or graft him on to our race; it withers or rots him. The half-caste problem threatens to become serious. In early days the tribes sometimes solved the problem by effective, if rough, means such as killing them all. The great difficulty is that the half-caste has no family life, or social place, or legal position with either blacks or whites; he is made to feel this and acts accordingly. Sometimes, no doubt, he has an honourable place among the blacks, or a place of trust among the whites; but this does not often occur. The increase in the number of half-castes is very marked. In South Australia during 1901-8 there was a decrease of 316 blacks and an increase of 125 half-castes. The years 1912-17 show a decrease of 148 full-bloods and an increase of 84 half-castes.

The dying out of the aborigines is due to a number of causes, some fairly well known. Epidemics of smallpox, or a disease indistinguishable from it, have almost annihilated whole tribes. This disease and venereal disease, introduced by the overlanders, was almost the sole cause of the extinction of the Coorong blacks. Venereal disease (which exterminates in another way also, by making the black women sterile) is widespread wherever there is contact with civilized people. Consumption, which is inseparable from the habits of clothing and housing, is responsible for a large number of deaths. It has been remarked that, while many die from our diseases, a great many also die from our medical treatment.

On 21 December 1839 Lord John Russell wrote to Sir G. Gipps:—'You cannot over-rate the solicitude of H.M. Government on the subject of the Aborigines of New Holland. It is impossible to contemplate the condition and the prospects of that unfortunate race without the deepest commiseration . . . . It is impossible that the Government should forget that the original aggression was our own, and that we have never yet performed the sacred duty of making any systematic or considerable attempt to impart to the former occupiers of New South Wales the blessings of Christianity, or the knowledge of the Arts and advantages of civilised life.' Some settlers in South Australia objected to sections of land being appropriated for the aboriginals before the white settlers were allowed to select. Governor Gawler replied:—'The invasion of those ancient rights by survey and land appropriations of any kind, is justifiable on the ground, that we should at the same time reserve for the natives an *ample sufficiency* for *their present* and future use and comfort, under the new style of things into which they are thrown; a state in which we hope they will be led to live in greater comfort, on a small space, than they enjoyed before it occurred, on their extensive original possessions.' On 1 August 1840 the South Australian *Register* in a leading article said: 'We say distinctly and deliberately that nothing comparatively has yet been done—that the natives have hitherto acquired nothing of European civilization, but European vices and diseases, and that the speedy extinction of the whole race is inevitable, save by the introduction of means for their civilization on a scale much more comprehensive and effectual than any yet adopted.' This might be reprinted to-day as a statement of fact applicable to the present position. Apart from some State pittance and a modicum of State supervision, the aboriginal is of little interest to anyone but some benevolent societies and a few very ardent anthropologists.

Before the coming of the white man, the black man's personal and racial needs were few and simple; his implements, intellect and habits were well adapted to supply those needs. While isolated in his primitive condition there was no need for much change, whether such change might be called advancement or not. This appears to be true of primitive peoples since the earliest times in the world's history. But circumstances change when outsiders, coming as invaders or as visitors, make the formerly isolated tribes feel, not satiable needs, but new insatiable wants, and exploit the population or the country, or both, for their own ends.

To one who knows how the blackfellow even in a single lifetime reacts to new influences—moral, intellectual and mechanical—the facts seem to upset all theories of cranial capacities, cerebral functioning and mental operations. They raise the question, indeed, whether ordinary anthropological investigations and tests supply the kind and amount of evidence with which we credit them for elucidating the evolution of races and the relations of peoples. It would appear that civilized man knows as little regarding the possibilities of the mind of his uncivilized brother as he does regarding those primitive savage instincts which he for a long time supposed to be dormant, dead, or never existent in the civilization to which he belongs. W.R.S.

See Spencer and Gillen's *Native Tribes of Central Australia* (1899), *Northern Tribes of Central Australia* (1904), and *Native Tribes of the Northern Territory* (1914); Walter E. Roth's *Ethnological Studies* (1897); E. M. Curr's *Australian Race* (1886); John Mathew's *Eaglehawk and Crow* (1899); Fison and Howitt's *Kamilaroi and Kurnai* (1880); Howitt's *Native Tribes of South-east Australia* (1904); N. W. Thomas's *Natives of Australia* (1906); W. Ramsay Smith's *In Southern Seas* (1924); Herbert Basedow's *The Australian Aboriginal* (1925); and *The Official Year Book of the Commonwealth*, No. 3, pp. 158-176. A fuller list of authorities is given at the end of the article on ABORIGINAL LANGUAGES.

Abrus, a small genus of twining or trailing plants of the family Leguminosae, chiefly tropical. The flowers are pink (rarely white); pod almost square at both ends; seeds brilliant scarlet, with a black blotch; leaves with several pairs of leaflets; the midrib ends in a point. The only indigenous species is *A. precatorius* (Weather-plant), the seeds of which are known as 'crabs' eyes' or 'jequirity beans' and made into necklaces and other decorative ornaments by the Pacific islanders, while Indian jewellers use them as a standard of weight.

Acacia, a genus of plants of the family Leguminosae, represented in the Australian flora by more species than any other. Out of 767 species known to botanists over 500 (as well as a number of forms) are indigenous to Australia. Akin to the mimosas of America, and themselves often known as mimosas in Europe, the Australian species are called 'wattles,' because their long pliant twigs were used by the early settlers in the construction of 'wattle-and-dab' huts (see CALLICOMA). The prevalence of the genus throughout the continent, characterized almost everywhere by profuse blooms, delicate in colour and scent, has made the wattle the national emblem; a literature and a sentiment have grown up round it, and 'Wattle Day' (q.v.) is an established anniversary in many centres of population. On the inland plains the generic name 'wattle' is

frequently superseded by aboriginal or vernacular names attached to particular species—e.g. Myall, Mulga, Dead Finish (*A. tetragonophylla*), Needle-bush (*A. rigens*).

The genus is divided into two principal groups, according to the arrangement of the flowers; in one group the inflorescence consists of a number of diminutive flowers in globular clusters, in the other of short golden spikes. A further grouping depends on the structure of the foliage; one section—of which the Green Wattle (*A. decurrens*) is an example—has

Green Wattle.

feathery (pinnate) leaves, whereas in the other section the axis of the leaf broadens into a leaf-like organ known as a phyllode, which performs the functions of an ordinary leaf. In all acacias the seedling leaves are feathery, any change to phyllodes occurring in the adult stage. The species vary considerably in size, from prostrate or matted forms a few inches high to shrubs and small trees; a few species attain a dignity of forest trees. Many flower in the early spring, and are very suitable as ornamental shrubs for parks and gardens, since their bright blooms—which range in colour from almost pure white to deep yellow—appear when but few other plants are in flower. They are not, as a rule, suitable for street-planting, being short-lived and exceptionally subject to the attacks of boring insects. Cutting the flowering twigs is not injurious to the plants—indeed, in most cases judicious pruning is beneficial—but roughly tearing them off injures the tissues, and prepares the way for disease and insect attack. Their cultivation is not difficult, though the hard nature of the seed-coat makes it necessary to assist germination by putting the seeds in water that has just boiled, and leaving them there until it is cold. Under natural conditions germination is hastened by bush-fires, after which the seedlings spring up in great abundance—a method often artificially applied in nurseries and plantations. The acacias are valuable agents in soil fertilization, as they have—in common with many legumes—the power of assimilating nitrogen by the activities of bacteria located in tubercles formed on their roots. They also yield a considerable amount of honey at a time when other flowers are scarce. Several species are stripped for their bark, which is in great demand for tanning. The species most valued for this purpose are the series grouped under *A. decurrens* (Green or Black Wattle of New South Wales), and the South Australian Golden Wattle (*A. pycnantha*); the latter is considered one of the best tan-barks in the world. Among other species that are stripped for their bark *A. falciformis* (Mountain Hickory), *A. binervata* (Two-veined Hickory) and *A. leiophylla* (Weeping Wattle of Western Australia) are prominent. The bark of all acacias is more or less astringent, and is used in domestic medicine as a decoction or infusion in cases of diarrhoea, dysentery, etc. Other useful products obtained from acacias are timber and gum. The gum is usually of a dark yellow or reddish-brown colour, and is generally found in large tears or masses. That obtained from species growing in arid districts is usually soluble in water, and makes an excellent mucilage; but it is not formed in large quantities, and is therefore commercially unimportant. The Mulga (*A. aneura*) of the western plains grows in dense thickets, the so-called mulga scrubs. Its leaves are relished by stock—in times of drought, indeed, sheep have subsisted wholly upon this diet. The shrubs are beset with two kinds of galls, one astringent and unpalatable, the other edible, large and succulent. The latter, known as 'mulga apples,' are very welcome to thirsty travellers in the arid interior. The excessively hard, dark-brown wood is used by the aborigines for boomerangs, nulla-nullas, shafts of spears, and sticks wherewith to dig up edible roots. This species ranges through the interior from E. to W. The Weeping Myall (*A. pendula*) is a useful fodder tree, sheep being very fond of the leaves, and in time of drought is an excellent stand-by; in many districts hungry sheep have exterminated it by eating down the seedlings, but horses are said not to relish it. The wood is hard, of a rich, dark colour, and beautifully marked. While unpolished it has a peculiar violet-like fragrance, a property which has brought it into request for making glove and handkerchief boxes. The aborigines make boomerangs of it. The species is found chiefly in the interior, and is regarded as an indication of good soil. The Green or Black Wattle (*A. decurrens*) is represented by several very distinct varieties, differing considerably in morphological characters and flowering seasons, but all highly ornamental trees. The Ironwood (*A. excelsa*) is the largest and most conspicuous species on the western plains, attaining a height of 50-60 feet, with a trunk-diameter of three feet. The timber is hard, interlocked, deep red in colour, with a beautiful figure. It is used for mining purposes where great strength is required; it also resists the action of sulphur in copper mines. When young, the stem is covered with spreading branches, but the mature tree has a clean trunk. This protective character in the young growth is characteristic of many western trees (see FLIN-

DERSIA). The Brigalow (*A. harpophylla*) a small tree, forms almost impenetrable forests in the interior (especially on the inland downs country in Queensland) known as 'brigalow scrubs.' The scimitar-shaped phyllodes have a characteristic blue-grey sheen.

The Blackwood (*A. melanoxylon*) is so called from the black colour of the mature wood, which is hard and close-grained and is classed with walnut for furniture-making. It is also used by billiard-table-makers and coachbuilders. Charcoal made from it burns with an intense heat. The best blackwood timber comes from Tasmania, where the trees reach a height of 60-70 feet. The species is chiefly eastern, extending from South Australia to Queensland. *A. Baileyana* (Cootamundra Wattle) is probably the most decorative species of the genus, and is most frequently cultivated as an ornamental

Long-leaved Golden Wattle (*A. longifolia*).

tree. Exclusively confined to New South Wales, it was described by Baron von Mueller, who named it in honour of the late F. M. Bailey (q.v.). *A. homalophylla* (Yarran), an inland species, has a dark-brown wood, valued for turnery on account of its solidity and fragrance. It has been extensively used in the manufacture of tobacco-pipes. *A. Cambagei* (Gidgee or Stinking Wattle) is frequently confused with yarran, from which it may be readily distinguished by the offensive odour of its foliage. It has a very durable timber, much used for fencing-posts. The wood is frequently marked with handsome parallel lines, caused by the uniform wavy grain; it is then known as ringed gidgee, and is much prized for making ornamental walking-sticks and stock-whip handles. The Native Willow (*A. salicina*) ranges across the inland areas of the continent. In the dry west it is a valuable fodder plant. The timber is tough and heavy, dark-brown and nicely marked. The aborigines make boomerangs of it; settlers use it for furniture. *A. Sophorae*, the Spreading Coast Wattle, ranges along the southern seacoasts and extends to Tasmania. The bark of this shrub has been used by fishermen, with a measure of success, to tan sails and nets. The aborigines of Tasmania used to roast the ripening pods and eat the seeds. It is useful as a coastal sand-binder.

A. rubida (Red-leaved Wattle) is an ornamental shrub with leaves frequently reddish-brown. In this species the young (feathery) foliage continues until the plants reach a height of several feet, when the adult foliage (phyllodia) appears. *A. implexa* (Hickory) is a medium-sized tree, found chiefly in the eastern coast-districts. Its foliage is eaten by stock. The wood is hard, dark-brown, with yellowish stripes, and is used for cog-wheels and other turnery in which strength and tenacity are required. *A. decora* (Western Silver Wattle) is a shrub found on the western plains of New South Wales. As the specific name implies, it is a highly ornamental plant. *A. Bakeri* is one of the largest of the acacias. A specimen on the mountains near Murwillumbah in New South Wales was 160 feet in height, with a diameter of two to four feet, and a trunk clear of limbs up to a height of 50-60 feet. The Currawang (*A. doratoxylon*), a shrub found chiefly on stony ridges in dry country, is of some service as food for stock in times of drought. *A. glaucescens* (Coast Myall), is a highly ornamental tree, with handsome flower-spikes and ashy-green pendulous foliage. *A. pycnantha* (Golden Wattle), is extensively cultivated as an ornamental tree, as well as for its valuable bark. It is most plentiful in South Australia, but extends through Victoria into New South Wales.

A. elata, the Cedar or Pepper-tree Wattle, is an ornamental tree resembling the well-known exotic Pepper-tree (*Schinus molle*). It is confined to elevated districts in New South Wales. *A. aulacocarpa* (Brush Ironbark) has a hard, durable timber. It is a central and northern species, known as 'dilka' by the Port Curtis blacks. *A. binervata* (Two-veined Hickory), an eastern coastal species, has a close-grained wood suitable for axe-handles, bullock-yokes, etc. It reaches a height of 30-40 feet. *A. Cunninghamii* (Bastard Myall) is a small tree, widely diffused. The timber takes a good polish, is dark in colour, and is useful for cabinet purposes; it resembles red cedar, but is much heavier. *A. Bidwilli* is the 'waneu' of the central Queensland blacks, who bake and eat the roots. The seeds of *A. cibaria* were eaten by the natives of Shark Bay. The timber of *A. acuminata*, a Western Australian species, has an odour resembling that of raspberries, which gives it the popular name of Raspberry-jam Wattle. *A. armata* (Kangaroo Thorn) is a prickly shrub, occasionally grown as a hedge.

See von Mueller's *Iconography of Australian Acacias, Key to the System of Victorian Plants*, and *Second Systematic Census of Australian Plants;* Bentham and Mueller's *Flora Australiensis;* Maiden's *Forest Flora of New South Wales, Wattles and Wattle Barks, Useful Plants in Australia*, and papers in the *Journal and Proceedings* of the Royal Society of New South Wales; Bailey's *Comprehensive Catalogue of Queensland Plants;* and Cambage's *Acacia Seedlings* in *Journal and Proceedings* of the Royal Society of New South Wales.

Acaena, a genus of plants of the family Rosaceae, dispersed over the temperate and cooler

regions of the southern hemisphere, and especially abundant in South America. Three species are indigenous to Australia, of which one (*A. montana*, a native of Tasmania) is probably peculiar to the country; the other two are also found in New Zealand and one of them in South America. The calyx-tube is bell-shaped; petals obsolete; stamens 2-10; fruit a dry carpel, enclosed in the hardened calyx-tube, which is usually closed at the top and more or less awned with spines or barbed bristles. *A. sanguisorbae* (known as Biddy-biddy Burr in Australia, Native Agrimony in Tasmania, and Piripiri in New Zealand) has numerous flowers in dense globular heads on long stalks; the fruiting calyces are 4-angled, with a barbed spine on the apex of each angle, the whole forming a large spiny burr. It is disliked by pastoralists, as the burrs are very tenacious, and their presence in wool lowers its value considerably. In *A. ovina* the flowers are arranged in clusters along an elongated flower-stem.

Acarina, an order of Arachnida (q.v.) comprising the mites and ticks. It is of great economic importance, as its members are chiefly (though not wholly) parasitic on mammals—including man—birds, reptiles, fishes, molluscs, insects and plants. In Australia 22 families—about 69 genera and 165 species—are known, but many (e.g. the cheese-mite) have been introduced with trade. Of the indigenous species little is known. A few have received names and have been described, for the most part very superficially. There is probably no section of the Australian fauna that offers such an extensive field for investigation, and yet has been so neglected. Some non-parasitic mites have developed a remarkable nymphal form (*hypopus*), which has a number of sucking disks on the ventral surface; these enable it to attach itself temporarily to some insect (spider, beetle, fly or butterfly) to be carried into a locality that suits it. Extreme cold or moisture has little effect upon mites. Many are the cause of loathsome diseases in man and the lower animals; e.g. *Sarcoptes*, which is responsible for itch in man and mange in horses, dogs, and cats, and the mites which produce erythema and 'grocer's itch.' To gardeners Red Spider (*Tetranychus bimaculatus*) is a well-known foliage pest, and a species of *Bryobia*, known as 'red mite,' attacks apple and pear trees in Australia. A eupodid mite related to the 'red spider' has of late years attacked oat crops in New South Wales, resting on the flag and sucking out the sap with its beak. It has a rounded beak, blue body, and legs of a brilliant red. The Root-mite (*Rhizoglyphus*) is a destructive cosmopolitan enemy to tubers and legumes, both in store and in the soil. All mites have eight legs in the adult stage, except the Eriophyidae, which have four. To this family belongs the world-wide *Eriophyes pyri*, which produce galls on the leaves of pear-trees, while allied species attack leaves and stems of other trees. The life of an acarid has four stages: egg, larva, nymph and adult. The majority are oviparous, a few are vivi- or ovo-viviparous, while *Pediculoides* is said to bring forth adults. *P. alastoris* occurs near Sydney.

Ticks affect cattle and sheep (see CATTLE-TICK, SHEEP-TICK), dogs, birds, and sometimes man. If one is picked up, it must on no account be forcibly removed, or the embedded barbed beak will break off and produce serious effects. A safe remedy is to smother the tick with oil (kerosene will do), when it will immediately back out. Bushmen sometimes apply nicotine from their pipes.

Acarids have few natural enemies beyond their predatory relatives, but there are cases of protective resemblance, especially among immature forms.

See Rainbow's 'Synopsis of Australian Acarina' in *Records of the Australian Museum*, vol. vi.

W.J.R.

Aciphylla, an alpine genus of plants of the family Umbelliferae, which occurs in Australia, New Zealand and the Antarctic islands. The calyx-teeth are prominent; petals often inflexed at apex; carpels dorsally compressed, usually with 5 acute prominent ribs. The leaves have broad sheathing bases. All the species are perennial herbs, with flowers in numerous umbels, each surrounded by an involucre of narrow bracts. *A. glacialis* (Mountain Celery), a robust plant, forms tufts in grasslands on the Australian Alps above 5000 feet, and bears a profusion of white, scented flowers. The sheathing bases of the divided leaves are marked with transverse lines and longitudinal striations. The tap-root is exceptionally long. *A. simplicifolia* has simple undivided, long, and narrow leaves.

Ackama, a genus of plants of the family Cunoniaceae, has two species, one endemic, the other occurring also in New Zealand. The calyx-tube is short, bell-shaped, 5-lobed; petals 5; stamens 10, inserted round a crinkle-edged disk; fruit-capsule small, turgid; seeds few, oval, hairy. The trees have opposite leaves, usually divided into 5 leaflets. *A. Muelleri*, a 'cork-wood,' is an eastern species with a soft, feathery inflorescence, and well deserves cultivation; in favourable circumstances it becomes a large tree. It has a tough, close-grained timber, with a purplish cast when fresh, which dresses well. Pouched structures known as domatia (q.v.) occur on the under-sides of the leaves.

Actinotus, a genus of plants of the family Umbelliferae, is endemic in Australia. The calyx-limb is truncate or 5-lobed; petals (when present) 5, rounded and concave; fruit oval, crowned by the persistent calyx-limb, compressed, 5-ribbed, without oil receptacles. The species are herbs, annual or perennial, and have flowers in compact umbels, surrounded by an involucre or herbaceous bracts. *A. Helianthi* is the Flannel Flower (q.v.) of New South Wales.

Adams, FRANCIS WILLIAM LAUDERDALE (1862-1893), son of Professor Andrew Leith Adams, F.R.S., F.G.S., was born at Malta on 27 September 1862, and educated first at a private school in Shrewsbury, and afterwards in Paris. After spending two years as assistant master at Ventnor College, he in 1882 migrated to Australia. In 1884 he published *Henry and other Poems* (London), and in 1885 *Leicester, an Autobiography*, which was followed in 1886 by *Australian Essays* (Melbourne), *Madeline Brown's Murder* (Sydney), and *Poetical Works* (Brisbane). In 1888 there appeared in Sydney *Songs of the Army of the Night*, which afterwards went through three editions in London. During his residence in Sydney he was regularly employed on the staff of the *Bulletin*. He left Australia in 1889, and in 1891 published in London *John Webb's End*, and contributed Australian sketches to the *Fortnightly Review*. After two years' stay in England (during which he published *The Melbournians*) he spent the winter of 1892-3 in Alexandria, struggling in spite of an incurable lung-disease to finish a book attacking the British

occupation of Egypt. During the summer of 1893 he went to live at Margate, England, where in a fit of depression he died by his own hand on 4 September 1893. *Australian Life* and *The New Egypt* appeared in 1893, the latter after his death; *Tiberius* (a drama) and *A Child of the Age* in 1894, and *Essays on Modernity* in 1899. Apart from the excellent and mature *Tiberius*, his literary work lacks restraint, and is interesting chiefly as a promise of what in riper years he might have achieved.

Adansonia, a genus of plants of the family Malvaceae, consisting of two species. *A. Gregorii* (Sour Gourd or Cream of Tartar Tree)—an endemic species confined to northern Australia—is hardly distinguishable from the exotic *A. digitata*, the well-known Baobab tree of South Africa. It is a large tree with a girth out of proportion to its height; some specimens attain a circumference of 80 feet at 2 feet from the ground. It grows on sandy plains and low stony ridges from the Glenelg River to Arnhem's Land, rarely above 100 miles inland. The huge trunk acts as a storage reservoir of food and moisture. The fruit, which resembles a small gourd, is about 6 feet long and 3-4 inches in diameter; its dry, acidulous pulp has an agreeable taste, and is peculiarly refreshing in the sultry climates of its habitat. It consists of gum, starch, sugary matter, and malic acid, and is said to taste like cream of tartar.

Adelaide, capital of the State of South Australia, lies in latitude 34° 55′ 38″ S., longitude 138° 35′ 04″ E., on the river Torrens, a few miles inland on the eastern side of the Gulf of St. Vincent. The site of the city was not decided on without many quarrels among the earlier colonists of South Australia. The first settlers (who arrived in July 1836 by the *Duke of York* and the *Lady Mary Pelham*) were landed at Nepean Bay on Kangaroo Island; but when Colonel Light, the surveyor-general, arrived in the following August, he made a temporary settlement at Holdfast Bay (Glenelg) on the mainland. After some delay and further explorations a safe and convenient harbour (called Port Adelaide) was discovered in the Gulf of St. Vincent; and Colonel Light selected a tract of rising land seven miles inland, on a stream afterwards called the Torrens River, as a site for the new colony's capital city. It was named Adelaide at the request of King William IV, in honour of his queen. The choice of the site soon caused considerable dispute; Governor Hindmarsh, among others, objected to it on the ground of its remoteness from the harbour, and wanted a site seven miles lower down the river, while expressing a preference for Encounter Bay. But the colonization commissioners in England, when appealed to, declared that Colonel Light's authority in the matter was absolute, and a majority of the colonists backed him. Experience has demonstrated the wisdom of his choice, and similar wisdom was exercised in laying out the city, which was made square in form, with ample provision for wide streets, public squares and park-lands surrounding all. In March 1837 the plan of the town was exhibited; 1042 acre-lots were marked out. 437 preliminary claims were satisfied (those who had contributed to the first fund raised for establishing the colony being allowed to choose their lots), and on 27 March 567 other lots were sold by auction at prices ranging from two to fourteen guineas. The total sales-money amounted to £3594.

The first houses were built of limestone, brick, *pisé*, and mud. A few wooden cottages also had been imported. The governor's house was of mud between laths, supported by uprights of native wood, and covered thickly with thatch; fire-places were forgotten in the plan, and a fire-place and chimney were afterwards built close to the front door. The architect was a sailor, and the workmen seamen from H.M.S. *Buffalo*. A depot for immigrants had been formed at 'Emigration Square.' This was originally called 'Forbes Square;' it was on the West Park-lands, not far from where the observatory now stands, and was not considered a very desirable situation.

The first newspaper published in South Australia was issued by Robert Thomas, who arrived in the *Africaine* in November 1836, brought a printing-press with him, and printed his paper in a rush hut at Holdfast Bay until the site for the city was fixed. The plant was then removed to a 'town acre' in Hindley-street, a little west of Morphett-street. The newspaper, the *South Australian Gazette and Colonial Register*, had been first published in London under that title on 18 June 1836, prior to the departure of the first band of settlers; the second number was published in South Australia on 3 June 1837 (and reprinted as a supplement to the *South Australian Register* of 2 December 1878). In 1858 a rival newspaper, the *South Australian Advertiser*, was established. Both newspapers, issued daily, still continue. The first Adelaide schoolmaster, John Banks Shepherdson (who was sent out by the South Australian School Society, and arrived a few months after the colony was founded), opened his school in a wooden building on the Park-lands, opposite where Trinity Church now stands.

In August 1840 a municipal corporation was created for Adelaide—the first in Australia; voters must have lived in the colony for six months and own city property rated at not less than £20. For the first election of councillors and aldermen polling-booths were erected at the intersection of King William and Hindley streets. James Hurtle Fisher headed the poll for councillors and was chosen mayor, a position that he occupied five times. A railway from Adelaide to Port Adelaide (7½ miles) was opened on 21 April 1856; it was extended to the Semaphore (1¾ miles farther) in January 1878. A new bridge, costing over £22,000, was built over the Torrens in 1856. The following year the park-lands were fenced in, and a portion planted. The exhibition building was erected and used for the first time for the February show in 1860. In 1839 the first botanic gardens were laid out by public subscription, not far from the old bridge called the 'Company's bridge,' that spanned the Torrens. The experiment apparently did not prosper, as in 1840 the gardens had been abandoned and were going to ruin. In 1854 the legislative council voted a sum of £3000 for the purpose of establishing a public botanic garden under government control, and on 10 March 1855 the present site was chosen. G. W. Francis, the first director, planned and laid out the garden. There is a cenotaph to his memory near the entrance. The university of Adelaide (see UNIVERSITIES), incorporated by act of parliament passed in 1874, was opened in April 1882, and the Elder Conservatorium of Music in 1898.

In June 1878 a system of horse-tramways was instituted by several private companies, and continued until 1906, when a municipal tramways

trust act empowered the South Australian government to acquire the lines with a view to their electrification. In 1907 a trust of eight members (two nominated by the governor, two elected by the city corporation, and two each by the suburban corporations and the district councils was formed, and 49 miles of horse-tramways were purchased at a cost of £280,372. The electric system was inaugurated on the Kensington route on 10 March 1909. On 31 July 1921, 62½ route miles had been electrified and opened for traffic; the corresponding length of track opened was 107 miles. The power-house is located on the river at Port Adelaide, nine miles from the city.

The water supply for Adelaide and suburbs is obtained from catchment areas of the rivers Onkaparinga, Torrens, and Sixth Creek, and from springs. Storage reservoirs have been constructed at Thorndon Park, Hope Valley, Happy Valley, and Millbrook; their total cost to 30 June 1924 was £3,100,856, and their storage capacity was 7,748,070,000 gallons, by which an ample supply of good water was available throughout the year. The length of mains laid in the metropolitan area is about 1076 miles, varying in size from 2 to 48 inches in diameter.

At the last census (4 April 1921) the population of Adelaide was 255,481 persons, of whom 134,711 (over 52 per cent) were females. In December 1924 the population was estimated at 278,856.

See SOUTH AUSTRALIA and books named there.

Adenanthera, a small genus of plants of the family Leguminosae, is tropical in habitat, with several Australian species. In the best-known of these, *A. pavonina,* the leaves are mimosa-like; flowers small, white or yellowish, in long, narrow spikes; pod narrow, curved, with more or less complete partitions between the seeds; seeds with a hard, shining red (or red and black) coat, about the size of a kidney-bean. The seeds are strung into necklaces and other articles of personal adornment.

Adenanthos, a genus of tropical plants of the family Proteaceae, occurring chiefly in extra-tropical Western Australia; *A. terminalis,* however, is found in South Australia and the Wimmera district of Victoria. The flowers are red or greenish, enclosed within a series of bracts (usually 6) forming an involucre; corolla-tube split more or less on the lower side, and usually falls off entire, leaving a very short ring-like base; style usually arched, protruding from the slit of the tube; fruit a small oblong nut; leaves entire or divided, often small and crowded, rarely rigid and prickly-pointed. The species are shrubs or small trees, erect or prostrate.

Agnew, SIR JAMES WILSON (1815-1901), born at Ballyclare in Ireland on 2 October 1815, and educated for the medical profession (M.R.C.S., Lond., 1838; M.D., Glasgow, 1839), migrated in 1839 to New South Wales, and after a short stay in western Victoria settled in Hobart in 1841. Here he practised his profession for 36 years, occasionally combining with it minor medical posts under the government. In 1877 he abandoned medicine for politics, was elected by Hobart to the legislative council, joined the Fysh-Giblin ministry (1877-8), and was for a short time a member of the second Giblin ministry (1879-81), being on both occasions minister without portfolio. After a visit to England he took over from Adye Douglas in 1886 the ministry which the latter had formed in 1884, but resigned in March 1887, and abandoned politics. He died at Hobart on 8 November 1901.

Agnew's real service to Tasmania had little to do with politics. From his arrival in 1841 he was prominent in scientific studies and in the encouragement of art; he helped to found the Royal Society of Tasmania, contributed valuable papers to its journal, joined the council in 1851, and became secretary in 1860; he was chairman of the boards that administered the public library and the museum, a member of the council of education, and for a short time a member of the council of the university. And his personal influence in Hobart, always exercised for good, was unique, making him a greater citizen than many who were more officially prominent. (K.C.M.G., 1894.)

Agricultural Education. In the year 1885 two agricultural colleges were founded in Australia, one at Roseworthy in South Australia, the other at Dookie in Victoria.

Roseworthy College opened with 15 students, and the attendance has steadily increased up to 66. In 1905 it was formally affiliated with the university of Adelaide, and candidates for the B.Sc. degree in agriculture have to spend two years at the college. It has about 2000 acres of land, on which the college buildings stand; about one hundred acres are under vines and fruit-trees, and the balance is divided between experimental work, general farming and live-stock raising. The college is under the immediate control of the department of agriculture.

Dookie College, on the fringe of the Goulburn valley between Shepparton and Benalla, has an area of 5920 acres; another college has been built at Longerenong in the Wimmera, eight miles from Horsham, with an attached farm of 2386 acres. Each college has over 1000 acres under cultivation. The revenue from 155,480 acres of Crown lands is set apart for the upkeep of these colleges, which are controlled by a council of agricultural education, consisting of 11 members, five being nominated by the governor-in-council and five elected by the agricultural societies of the State. The director of the department of agriculture is *ex officio* a member of the council, and its treasurer. Dookie has accommodation for 120 resident pupils, Longerenong for 60. Approximately 2000 students have passed through these colleges.

In 1888 the government of New South Wales founded a department of agriculture and established a complete system of government farm schools, apprentice schools, experiment farms and demonstration farms throughout the State, with an agricultural college at Richmond on the Hawkesbury River, 38 miles from Sydney. This college is the largest in the Commonwealth. Accommodation is provided for 200 resident pupils, each student having a separate room. All the buildings are lighted by electricity. The farm has an area of 3440 acres of land, about 1000 acres of which are under cultivation. At an attached farm on the banks of the Hawkesbury, comprising 116 acres of rich alluvial soil, a complete system of irrigation is carried out, in order to train students intending to take up areas on the State irrigation settlements.

The Queensland government in 1897 founded a college at Gatton on the main southern line, 55 miles from Brisbane, with accommodation for 60 resident pupils. In 1924 this was reorganized as the Queensland Agricultural High School and College, and placed under the de-

partment of public instruction, which feeds it from the State's 'rural schools.' Boys are admitted at the age of 14 (some join even earlier); there are two courses, a junior and a senior, of three years each, and in the sixth year students specialize either in agriculture or in dairying. At the apex of the system is the university course in agriculture. The college farm comprises 1692 acres, of which 700 are under cultivation. Particular attention is paid to dairying, and to the building up of pure-bred herds of Jerseys and Illawarra shorthorns.

Western Australia possesses an agricultural college, situated at Narrogin on the great southern line, 162 miles from Perth, which provides a two years' course for 25 resident students from 14 to 18 years of age.

All the principal agricultural colleges aim at training men who will adopt farming as an avocation, and their curriculum is devised to fit students for farming of all kinds—mixed, irrigation, dairy, wheat, pig and poultry—or for work in orchards, vineyards and apiaries. Students are also prepared as technical teachers, dairy-factory managers, butter-makers, cheesemakers, milk-testers and inspectors.

Practical training and experience are given in every phase of farm practice, including the handling of live-stock; and on the attached experimental farms are tested the comparative values of fertilizers, systems of crop-rotation, methods of soil-culture, new plants, and the commercial values of various crops. The growth of pure seed, the selection of new varieties and types, the control and suppression of disease in plants and animals, all have attention; and in the college laboratories provision is made for teaching chemistry, economic botany, zoology, soil physics, bacteriology, mechanics and farm engineering, veterinary science and practice, mathematical surveying and levelling, entomology, vegetable pathology, forestry and farm book-keeping. In addition, each student has to become familiar with tools and phases of work not considered essential in more densely populated countries. Many settlers are beyond the reach of tradesmen and repair-shops: agricultural students therefore receive practical training in blacksmithing, carpentry, butchering, and the work of wheelwrights and saddlers. Gardening is not neglected, and the usual social and athletic adjuncts of college life are well provided for. Winter schools lasting four weeks are provided at the slack period of the year for busy farmers and stock-owners, who can devote only a limited time to study and intensive practical instruction. Farmers select the branches of training best suited to their own farms and districts, and often bring to the colleges for solution local problems of cultivation or troubles with live-stock. The departments of agriculture and education in each State collaborate with the State university in all matters relating to specific training in nature study, agriculture and allied subjects; this, at all schools and colleges which the State can influence, is so devised that a student's training may proceed regularly towards the university's Bachelor of Science degree in agriculture. Nature-study, elementary agriculture, and school gardens are being steadily introduced in state primary schools as portion of the curriculum. Agricultural high schools in country centres train lads up to 16 years of age; successful students proceed to the agricultural colleges to complete their training.

Courses established in the universities of Adelaide, Melbourne and Sydney provide special training for the higher branches of agriculture. Students who have shown peculiar aptitude in the high schools and agricultural colleges are offered scholarships and bursaries. The chairs of agriculture at these universities have already demonstrated their value; they have made available specialists competent to deal with insect pests, who are making their influence felt in research work. Of late years farmers are individually visited and influenced by inspectors (or rather instructors) from the agricultural departments, who conduct actual experiments on practical lines in each district to demonstrate the best classes of fodders, etc., to grow, and endeavour to collect local data and ensure a more economic application of type and method on the farms. They also organize, assist and stimulate the formation of agricultural bureaux for instructional purposes. This system of grouping farmers for instruction is becoming very popular, and has resulted in special exhibits at local agricultural shows of district collections of produce staged by members of the bureaux. The Royal Agricultural Society of New South Wales also does its best to develop agricultural education; it makes provision at the annual shows for lectures and demonstrations to students, thus giving object-lessons in the form of the best stock and produce the country can provide. At each show, too, popular lectures are given to farmers. A number of agricultural societies devote part of their income to prizes, scholarships and exhibitions for deserving and competent students, to enable them to pursue courses of training in agricultural and veterinary science at the universities and agricultural colleges. Furthermore, the public library at Sydney includes a large collection of modern books relating to every phase of rural occupation. A special catalogue is issued, from which enquirers may select books applicable to their wants, and these books are sent free on loan to every part of the State.

H.W.P.

Agriculture is one of the three most important sources of Australian wealth—less so than the manufacturing industry, but practically on a level with the pastoral industry. On the figures for the last four years (1919-23) the value of Australian manufactured products has averaged £115,000,000 a year, that of agricultural products £87,769,000 and that of pastoral products £87,133,000—roughly speaking, 30 per cent, 22½ per cent, and 22¼ per cent of the total production-value. Details of the principal crops and of any local methods used in growing them will be found under their names; this article deals with (*a*) the history of the progress of agriculture in the various colonies, and (*b*) information about growing, marketing, government assistance, etc., that are applicable to all or most crops.

Historical Sketch. New South Wales.—Among the 'Instructions for our trusty and well-beloved Arthur Phillip, Esq.' issued to the first governor of New South Wales on 25 April 1787 was one ordering him immediately upon landing to proceed to the cultivation of the land, and another that he should with all convenient speed report on the actual state and quality of the soil at and near the settlement and the probable and most effectual means of improving and cultivating it. A good deal of 'corn and other seed-grain' was shipped in the First Fleet, but Phillip was authorized to obtain more at any port on his route: so at Rio de Janeiro he procured coffee (both seed and plant), coco in the nut, cotton-seed, banana-plants, oranges (seed and

plant), lemons (seed and plant), guava (seed), tamarinds, prickly pear (plant, with cochineal on it), eugenia or pomme-rose, ipecacuanha, and jalap. To this collection he added at the Cape of Good Hope plants of fig, bamboo, Spanish reed, sugar-cane, vines, quince, apple, pear, strawberry, oak, and myrtle. When the expedition reached Port Jackson these were set in plots on the east side of Sydney Cove, near the house erected for the governor. At the head of the next bay eastwards (now Farm Cove) a small area of land was cleared for a farm; this land now forms part of the Sydney botanic gardens. Among the 1030 persons then landed there was only one farmer. One or two others understood a little about farming; but the need for gardeners, and for men capable of supervising agricultural work—in an unknown country, on inferior soil, with a capricious climate, and many unexpected obstacles to contend with—was repeatedly and pathetically urged by Phillip. Difficulties accumulated. 'Most of the axes' wrote Phillip, 'spades and shovels the worst that ever were seen. . . . . Of the seeds and corn sent from England part has been destroyed by the weevil; the rest is in good order.'

Finding it useless to attempt farming on the sandstone soil about Sydney, Phillip discovered a more promising locality 'near the head of the harbour,' which he named Rose Hill (afterwards Parramatta). About May 1790 all attempts to raise a sufficient supply of food failed, and the colonists were reduced to a condition of semi-starvation, when the arrival of several supply-ships afforded timely relief; but the lesson was learned. 'Vigorous measures' wrote Tench, 'were adopted to give prosperity to the Settlement. Large tracts of land were ordered to be cleared at Rosehill and prepared for cultivation. The plough has never yet been used here; all the ground is hard and very imperfectly turned up. Each convict labourer was obliged to hoe sixteen rods a day, so that in some places the earth was just scratched over.' With such imperfect preparation of the soil it seems remarkable that any crops were obtained; but in December 1790 300 bushels of wheat and 60 bushels of barley were harvested, as well as small quantities of flax, maize, and oats, which were preserved for seed. In a despatch dated 17 June 1790 Phillip reported: 'In order to know in what time a man might be able to cultivate a sufficient quantity of ground to support himself, I last November ordered a hut to be built in a good situation, an acre of ground to be cleared, and, once turned up, it was put into the possession of a very industrious convict, who was told if he behaved well he should have thirty acres.' This grant, the first issued in Australia, was made to James Ruse (q.v.) on 22 February 1790. The land is described as 'Experiment Farm;' the cottage to which a portion of it is still attached is to-day known as 'Experiment Cottage.' Ruse's grant was confirmed by the British authorities on 30 March 1791.

The success of Ruse acted as an incentive to cultivation. Phillip offered free grants of 100 acres to non-commissioned officers and 50 acres to privates, while others were encouraged to settle. At the end of the year there were 950 acres cleared and cultivated about Sydney and Rose Hill. In March 1791 Phillip was able to write that 'the settlement is so fully established that the great labour may be said to be passed: . . . though it is not independent for the necessaries of life;' and by the end of that year 30 emancipists and three men still under sentence had been settled on blocks of 30 to 50 acres, some at Subiaco and Carlingford, others on and north of Prospect Hill. In 1792 good soil was found still farther north, about three miles NW. of Parramatta, and a new settlement was formed there, to which Phillip gave 'the name of Toon-gah-be, a name by which the natives distinguish the spot. . . . The quantity of ground in cultivation by the settlers is 416 acres, and they have 97 acres more ground cleared of timber.' At this place there was a government farm, and later on a stockyard for government cattle was built. The same year Phillip reported that 'Our last year's crop of maize, notwithstanding the long drought, was 4,844½ bushels, of which 2,649½ bushels have been issued as bread for the colony, 695 bushels reserved for seed and other purposes, and not less than 1,500 bushels were stolen from the grounds.' But in 1802 King declared that 'the extent of ground about Toongabbee designed by Governor Phillip for public cultivation has been mostly granted away to settlers, leaving Government a very circumscribed space not containing more than 300 acres of entirely worn-out land, which has been in constant cultivation.' In October 1793 Grose reported that 'there is but little doubt of our reaping as much corn this harvest in the colony as will supply us the ensuing year.' The most fertile locality was Prospect Hill, where 'some grounds returned 30 bushels of wheat for one bushel of seed.' By this time two new settlements had come into existence—the Eastern Farms, in the Ryde district east of Carlingford, and Liberty Plains, about halfway between Sydney and Parramatta. The latter settlement, originally peopled by free settlers who reached Sydney in the transport *Bellona* on 15 January 1793, lay in the area now occupied by the modern suburbs of Strathfield and Homebush and adjoined Concord, which was allotted mainly to non-commissioned officers of the New South Wales Corps; the use of the name 'Liberty Plains' to denote the Bankstown district, some miles to the south, is of later date.

In January 1794 Grose initiated the Hawkesbury settlement, under the name 'Mulgrave Place,' in a district examined and approved by Phillip in 1790. Williams, Ruse, and others were permitted to open ground on the banks of the Hawkesbury; Ruse's new farm was situated at the junction of South Creek with the Hawkesbury. The alluvial soil of that district was found to be extremely fertile, and altogether different from any previously cultivated. Grose reports the first settlers' opinions thus: 'I have settled on the banks of the Hawkesbury twenty-two settlers, who seem very much pleased with their farms. They describe the soil as particularly rich, and they inform me whatever they have planted has grown in the greatest luxuriance.' John Macarthur's farm at Parramatta (which joined Ruse's) contained nearly 250 acres, of which, wrote the owner towards the end of the year, 'upwards of 100 are under cultivation, and the greater part of the remainder is cleared of timber which grows upon it. Of this year's produce I have sold £400 worth, and I have now remaining in my Granaries upwards of 1,800 bushels of corn. I have at this moment 20 acres of fine wheat growing, and 80 acres prepared for Indian corn and potatoes with which it will be planted in less than a month.' He had ten convicts allowed him for clearing

and cultivating his farm. On this farm the plough was used for the first time in Australia, in the spring of 1795.

In June 1795 the number of Hawkesbury settlers with their wives and children was 400 or more, and their farms extended 30 miles on both sides of the river. They were at times considerably annoyed by the blacks. In 1798 an area of upwards of 6000 acres was under crop, but in January 1799, owing to a severe drought, the crops were almost a complete failure. The drought was followed by very heavy rain in June, and the resulting floods caused great destruction among the farms, and loss to settlers. In 1801 King reported that out of 10,800 acres of cleared land not more than 8421 were cultivated, mainly because owners were either too ignorant or too poor to utilize them. Four floods in the Hawkesbury during the summer of 1800-1 destroyed produce to the extent of 'sixty weeks' consumption for those victualled from the stores.' At the Hawkesbury the new crop averaged 25 bushels per acre ('but 35 have often been produced'); 12-14 was the average elsewhere. And so the industry went on—confined within the narrow bounds of the county of Cumberland, where most of the soil was unfit for farming and the best areas were subject to disastrous floods. Bligh was the first governor who took agriculture seriously—i.e., as an industry apart from the need of food for the settlement; and it is probable that his interest in it arose largely from his dislike of Macarthur and the sheepowners. 'Our utmost exertions' he wrote in February 1807 'must likewise be to Agriculture to supply the Shipping, and the collateral advantages of a Wool Trade will then be supported by competent means.' After his deposition the area in cultivation fell off by 2000 acres. He was also much interested in manuring, clean cultivation, and the importation of exotic grasses. Macquarie, benefiting from a three-years' lack of floods, reported in 1813 that the harvest was excellent: at the time (according to figures compiled in October 1812) nearly 150,000 acres were in occupation, 85 per cent being pasture-land; 9428 acres were under wheat, 4783 under maize, 1832 under other crops, and 6654 lay fallow. 4521 men were employed in farming, of whom 625 were free.

This represents the maximum effort, one may be sure, of the colony at the moment, i.e. before the crossing of the Blue Mountains. As soon as possible after that achievement wheat was sown at Bathurst, and in March 1816 Macquarie reported that it was 'of a Very superior Quality to the Wheat Generally Grown on this Eastern Side of the Blue Mountains.' In 1821 the official figures showed over 380,000 acres in occupation, 17,000 under wheat, 11,000 under maize in New South Wales; in Tasmania nearly 274,000 acres were occupied, 13,000 of which were under wheat. On the mainland by 1830 the settled areas lay northwards in the alluvial flats of the Hunter valley and at Port Macquarie and Brisbane; southwards along the Illawarra coast; inland from Bathurst to Wellington, and from the Goulburn plains to the Monaro country. In 1838 the total area under crop on the mainland of Australia was 92,912 acres. On that area 48,060 acres of wheat yielded 469,140 bushels: 25,043 acres of maize yielded 556,268 bushels: 2922 acres of barley gave 32,103 bushels: 3767 acres of oats yielded 13,416 bushels: 429 acres of rye yielded 4878 bushels: 39 acres of millet yielded 353 bushels of seed: 1788 acres under potatoes yielded 3496 cwt.: 925 acres in tobacco yielded 4952 cwt.: and 9939 acres of sown grasses yielded 6960 tons of hay. Agricultural labour was greatly needed, and the land revenue was employed to assist migrants from the United Kingdom.

In 1841 the acreage under cultivation (which had doubled since 1833) actually diminished, partly because of the serious financial crisis of that year; but in 1842 a recovery was effected, and by 1845 the cultivated area had increased to 164,000 acres. The fine agricultural country beyond the mountains, however, was still practically undeveloped, as the expense of carting crops to the seaboard was too great. In 1846, therefore, the construction of a railway across the Blue Mountains was suggested; but not till 30 years later was it completed even as far as Bathurst. In 1851-5 the spread of agriculture was hampered by the gold discoveries, the vast influx of adventurers, and the practical cessation of transportation. The cultivated area decreased from nearly 200,000 acres in 1850 to 132,000 in 1852, and did not regain the 1850 level until 1858 (223,000 acres); it then increased slowly to 1864 (319,000) and rapidly to 1866 (451,000), about which figure it fluctuated until 1875; then began another steady increase until 1880 (706,000). These increases correspond roughly to the extension of the railways. Thus by 1864 the Hawkesbury and Hunter valleys had obtained railway connection with the seaboard; in 1869 (a year of sudden agricultural expansion, which was not kept up), the railway had crossed the southern range to Goulburn and the western as far as Bowenfels; and the steady increase of 1875-9 may be attributed to the opening of a western section to and past the rich Bathurst Plains. Not yet, however, was the colony agriculturally self-supporting. Experts in 1870 stated that 'we can produce wheat of a quantity that can stand the competition of the world, but we cannot do it at the necessary price. The cost of labour is too expensive for rude processes, and we have not yet attained to such proficiency in the use of labour-saving machinery as would counterbalance the rate of wages.' And up till 1896 a considerable proportion of the New South Wales population depended for its food-stuffs on importations, mainly from Victoria.

From 1895 onwards the introduction of improved methods of farming coupled with the strain put on owners of unproductive land by Reid's 'unimproved values' land-tax, greatly increased the cultivated area in New South Wales; in 1895-6 only 1,348,600 acres were under cultivation; in 1905-6, 2,840,235 acres; and in 1915-6, 5,796,376 acres. But the war withdrew the pick of the agricultural labourers, and otherwise disturbed industrial conditions, so that in 1919-20 the tilled area was well under four million acres, and by 1922-3 had increased only to 4,696,459 acres, of which 2172 acres were in the Federal Capital Territory.

Tasmania.—In Tasmania the production of crops progressed at first so well that in 1805 (two years after colonization commenced) more wheat was produced than the settlement needed. In the following year, however, crops failed, and the price of wheat rose to £4 a bushel. But good roads were soon made, new land was opened up, encouragement was given to agricultural settlement and soon free settlers arrived from Great Britain, including retired naval and military officers and persons with sufficient capital to make a satisfactory start. Each settler

received a grant of land, the area being in proportion to the capital brought with him, up to a maximum of 2560 acres. The chief products raised about 1820 were wheat, barley, potatoes, and a little oats. The area under cultivation was 8330 acres. The average yields at Port Dalrymple were: wheat 25 bushels per acre, barley 40 bushels, oats 50 bushels. Large quantities of potatoes were sent to Sydney. English grasses were sown extensively for hay, which realized at Hobart £10 a ton; Launceston hay was 50 per cent cheaper. In 1847 the value of grain, hay, and flour exported was £141,377.

The gold discoveries on the mainland caused such an exodus of men from the colony that many districts were almost deserted by the male population; by degrees, however, most of the gold-seekers returned, and in 1853 the island began to show evidences of remarkable prosperity. The Victorian goldfields needed food, and, while South Australia supplied a good deal of wheat, other grains and vegetables were in great request. About that time the lands of north-western Tasmania were opened up, and found to be admirably suited for the production of potatoes. By degrees a lucrative trade in that product developed, but the land was so heavily timbered that clearing was expensive. In other ways, too, progress was slow, partly owing to the system of issuing free grants of extensive areas of land. Up to the end of 1864 a total area of 2,960,765 acres had been given away, and during the same period only 1,278,748 acres had been sold.

As might be expected in the colder climate, Tasmanian agriculture has occupied itself rather with oats, peas, and potatoes than with wheat. The limited area available for cultivation—since great districts of the centre and west are too rugged or too forest-covered to make cultivation profitable—prevented any great development after the early settlers had absorbed the rich and easily attainable patches. The following figures indicate the development which has been possible:—

	1860	1880	1900	1920	1922-3
Acres cultivated	152,860	140,788	224,352	297,383	298,611
Under wheat	66,450	50,022	51,325	28,284	25,244
Under potatoes		9,760	23,068	32,000	34,407
Orchards		6,717	11,485	37,013	34,689

In spite, therefore, of her small area Tasmania produces more potatoes than any State except Victoria, and more fruit than any except Victoria and New South Wales.

Victoria.—In 1839, four years after the beginning of the settlement, very little land was cultivated, but by 1842 an area of 8124 acres was under crop (2432 under wheat). In 1845 the cultivated area had increased to 25,134 acres (11,141 under wheat). About Melbourne wheat, oats, and potatoes were grown. At Western Port a little maize was cultivated, at Portland wheat, oats, and potatoes and at Geelong wheat, oats, barley, and vegetables. The conditions that hampered farming in New South Wales—barren ranges which intervened between the best farming districts and their port, and the consequent high cost of transport—did not hamper Victorians to the same extent, and, in spite of land laws that by no means encouraged immigrants to farm, over 50,000 acres were under cultivation by 1850. The inrush of gold-seekers and the depletion of local labour threw 20,000 acres out of cultivation in the next few years; but, as in Tasmania, the needs of the diggers stimulated production, better legislation opened up the lands (in 1857 alone half a million acres were sold), and by 1865 448,000 acres were being cropped and the necessary importation of food-stuffs had decreased by at least 60 per cent.

A protective tariff imposed in 1871 benefited agriculturists considerably—an import duty of 1s. for every hundred pounds' weight of grain and pulse of every kind; on onions 20s. a ton, on potatoes 20s. a ton, and so on. During the same year the completion of 315½ miles of railway also advantaged the farmers, but the colony was still obliged to import over a million bushels of wheat. In 1885 a royal commission on vegetable products recommended a 'judicious system of offering bonuses for new vegetable products, and for the further development and improvement of vegetable products already established.' By the end of 1890 over £370,000 had been paid in bonuses, and in 1894 the commission claimed great credit for the good done.

About 1880 Victoria began to utilize her share of the 'mallee' country, a region which occupies the great bend of the Murray from (roughly speaking) Swan Hill to Murray Bridge. Settlers were aided to cultivate their farms by the prior destruction of the dense scrub which covered nearly 11 million acres of Victorian territory; it was too thick to clear by ordinary methods, so heavy rollers and wooden frames were dragged over the mallee with traction engines, the timber thus crushed down was burnt off when dry, and the land then ploughed with stump-jumping ploughs (a local invention) and harrowed with stump-jumping harrows. The stumps were afterwards removed by degrees. For many years before the advent of the Commonwealth Victoria was the granary of Australia; envious squatters from New South Wales might call it contemptuously 'the cabbage-garden,' but its prosperity, founded on gold, was ensured and strengthened by agriculture; not until 1913-4 did it lose the agricultural primacy of Australia. In 1860 it had under crop 387,282 acres; in 1880, 1,548,809; in 1900, 3,114,132; in 1920, 4,489,503. The latest figures available—those for 1922-3—show 4,862,548 acres under crop, of which more than half was in wheat and nearly a third in oats grown for seed or hay. While New South Wales grows more wheat and maize, Victoria tops all the other States in oats, hay, fruit, and potatoes; and its proportion of cultivated to uncultivated land —eight per cent—is nearly four times as great as that of New South Wales (the next State) and ten times that of the Commonwealth as a whole.

Queensland.—In the early days of settlement Queensland was considered to be suited for pastoral purposes only, though when a penal settlement was formed at Brisbane, and a smaller one at Ipswich, land near those centres was cultivated, chiefly for fruit and vegetables. Wheat-growing was tried with some success near Ipswich, and maize throve at both settlements. In 1847 Dr. Lang (q.v.) conceived a scheme for utilizing the coastal districts to grow cotton, and in 1849-50 brought out three shiploads of migrants to establish a cotton-growing

colony near Brisbane (see COTTON). Ten years later, however, when Queensland was separated from New South Wales, the area of cultivated land in the new colony was 3557 acres only, situated near Brisbane, Warwick, and Toowoomba. During the American civil war (1861-5) Lang's idea again came to the front, and for some years Queensland cotton-planters made money; but with the return of peace the price of cotton fell, and the industry was ruined. During those years, however, some planters had been experimenting with sugar-cane, and the introduction of Kanaka labour by Robert Towns for a time supplied the cheap labour that the cane-fields so urgently needed. The relation of the sugar industry to Queensland agriculture in general is shown in the following table:—

	Area under crop	Area under cane	
1860-1	3,353	—	
1870-1	52,210	6,342	(12%)
1880-1	113,978	20,224	(17¾%)
1900-1	457,397	108,535	(23¾%)
1920-1	779,497	162,619	(20%)

In 1922-3 24 per cent of the total cultivated area was under cane—202,303 acres out of 835,060. The physical geography of the State makes it especially the home of tropical and subtropical crops and fruits. It produces not only 90 per cent of Australian sugar, but 41 per cent of its maize. Its wheat crop is small, although varieties suitable for subtropical conditions have been bred by several agricultural experts, notably Joseph Bancroft (q.v.). Southern Queensland has large areas under green forage crops, mainly maize, lucerne, and sorghum for dairy purposes; in this respect Queensland heads the States, with 35 per cent of the total product of the Commonwealth.

South Australia.—When the first settlers at Adelaide saw the hard, sun-baked soil of their new country, they were despondent about raising crops; a trial, however, made on 20 acres within the town-limits showed that excellent wheat could be produced, and since then wheat has been the staple crop of South Australia. In 1850, about ten years after the first wheat trial was made, the area of land under cultivation was 64,728 acres (41,807 under wheat). The gold discoveries, as in other colonies, at first depleted the agricultural labour market, but after a while stimulated agriculture very greatly; in 1860 the area under cultivation had increased to 428,816 acres, of which 273,672 were under wheat. From that time onwards agriculture progressed steadily, and exports of wheat and breadstuffs increased. At one time a little flax was grown, and fibre marketed in England realized a good price.

As settlement increased, cultivation extended into regions hitherto regarded as desert—e.g. the South Australian part of the mallee country. South Australia began operations in her mallee districts much later than Victoria, but is now 'gridironing' it with railway lines and adding its area to her wheat-fields. The following figures indicate her success:—

	Acreage under crop	Acreage under wheat	
1860-1 ..	359,284	273,672	(76%)
1880-1 ..	2,087,237	1,735,542	(83%)
1900-1 ..	2,369,680	1,913,247	(80½%)
1920-1 ..	3,231,083	2,167,646	(67%)
1922-3 ..	3,575,452	2,453,086	(68½%)

The decrease in the percentage of wheat-land since 1900 is partly due to a great increase in the acreage put under barley, which began to expand in 1902, and has since then decupled itself; South Australia in 1922-3 produced over 56 per cent of the Commonwealth yield of barley.

Western Australia.—In 1831, two years after the Swan River settlement was founded, 200 acres only were under cultivation; in 1834 the 1600 settlers had managed to clear and cultivate 918 acres, of which 364 were under wheat. Two years later sufficient wheat was produced to meet the requirements of the colony. In 1838 the settlers had increased to 2000, and cultivated 2447 acres, but suffered from lack of labour; ordinary farm-servants' wages were from £2 to £3 10s. a week with board, etc. In 1845 cultivation had increased to 4836 acres (3313 under wheat). Finding it impossible to procure labour, the settlers petitioned the British government to constitute the colony a penal settlement, and the first shipment of convicts landed in June 1850. From that time onwards the cultivated area increased, but very slowly; even the discoveries of gold at Coolgardie (1892) and elsewhere did not greatly stimulate agriculture, though after the establishment of the Commonwealth the annual expansion was more marked. After 1905, however, a considerable growth was recorded, as the areas along the York-Albany railway line and the coastal region from Perth to Bunbury were opened up for settlement and branch lines thrown out into the new tillages. In the season of 1860-1 24,705 acres were under crop; in 1880-1, 57,707; in 1900-1, 201,338; in 1920-1, 1,804,987. In 1922-3 2,274,998 acres were under crop, 1,552,868 of them under wheat.

An account of the progress of agriculture in the *Northern Territory* will be found under that heading.

General.—Australian agriculture reached its maximum of production in 1915-6 when, as the result of a special effort to supply war-needs oversea, 18,528,234 acres were put under cultivation. The German 'submarine campaign,' however, soon made it impossible to ship foodstuffs to England, and production fell off rapidly until 1920-1. In 1922-3 the tilled area for all Australia was 16,543,555 acres, of which 59 per cent was in wheat, 10 per cent in other cereals grown for grain, and 25½ per cent in hay and green-fodder crops. In New South Wales, Victoria, South Australia, and Western Australia wheat-growing occupies the biggest area; Queensland allots most space to cane, and Tasmania to oats. The average yield of wheat per acre fluctuates greatly: in 1922-3 the average for all Australia was 11.21 bushels, but for Tasmania the average was 22.56 bushels and for Western Australia 8.92. In 1920-1 the Australian average was 16.08 bushels, but this was exceptional and only once (in 1866) exceeded in the history of Australian agriculture. More attention has been given in recent years to the improvement of the industry by extending the practice of fallowing and the rotation of crops; it is still true to say, however, that on the whole the Australian wheat-farmer grows the one crop year after year in the same field, occasionally turning up the soil at the end of the harvest and allowing it to lie fallow until the next sowing period; though where dry farming (see WHEAT) is practised a fallow between crops is, of course, essential. Much land previously considered useless or inferior for cultivation has of late years been made available by the use of fertilizers, especially phosphate (see MANURES and MANDATED TERRITORIES). The development

of irrigation (q.v.) has also extended the area of intensive farming.

State governments assist farmers both financially and educationally. Advances may be obtained on the security of a first mortgage from special branches of the State savings banks (in some cases from separate agricultural banks) to pay off existing liabilities, to make agricultural improvements, to erect permanent buildings, etc. The various State departments of agriculture control schools and training farms (for which see AGRICULTURAL EDUCATION); they also carry out investigations in entomology and vegetable pathology (e.g. in New South Wales extensive experiments have been made to ascertain the most effective method of protecting stored maize from insect pests), examine specimens sent to them to determine the presence and nature of disease, and breed new varieties of seed—some States distribute such seed freely for experimental purposes to farmers. Occasionally also departments assist in developing markets by exhibiting samples of produce and collecting information for publicity overseas.

Share-farming.—During the greater part of the 19th century Australian farming was carried on either by owners or by ordinary tenants. But about 1893 there grew up in south-western New South Wales an adaptation of the metayage system so common in Italy and France. The details of 'share-farming' contracts varied with the district: thus in some cases the landowner provided everything but the labour and took two-thirds of the crop in return, in others the farmer provided plant, labour, and half the bags required and took half the crop—in one such case, as a stimulus to good farming, the whole yield between 20 and 25 bushels per acre went to the farmer as a bonus, so that a 30-bushel crop would go 12½ bushels to the owner and 17½ to the farmer. Where the landowner takes an active interest in the farm these contracts have been found very beneficial and educative: indeed, good landlords have always regarded them as educational, have looked forward to losing their tenants after a few years, and have often refused to renew the contract after that time. An official enquiry made in 1910 elicited from a number of former share farmers the opinion that five years of it was long enough to set any man on his feet and let him buy land of his own, while if the man had a little capital to begin with he should be independent in three years. The system has also been applied to dairy-farming. In a typical case the owner provided stock, milking-plant, residence, and seed for the first food-crops, and the tenant labour, agricultural plant, and horses; the tenant took 7s. 6d. for every calf reared and half the net proceeds from butter. Of late years the system has gained much popularity, and except in Tasmania the man without capital prefers share-farming to ordinary tenant-farming.

See AGRICULTURAL EDUCATION, DAIRYING, and articles on the various crops. For the early settlements near Sydney see J. F. Campbell's 'Dawn of Rural Settlement in Australia' in vol. xi of the *Journal* of the Royal Australian Historical Society. W.S.C.

Agrimony. See ROSACEAE.

Albacore (*Thunnus germo*). Though this fish has been recognized from Australian waters upon one occasion only, it is probably plentiful in the open seas along our coasts, together with many other oceanic members of its family, the Scombridae. It is closely allied to the well-known tunny, but is distinguished from that species by its much longer pectoral fins. The albacore attains a length of four feet, and is distributed over all warm seas. It is almost worthless as food. A.R.McC.

Albatross, a large sea-bird of the family Diomedeidae, peculiar to the Pacific and Southern Oceans. Most of the species found in the Southern Ocean appear in Australian seas during the winter, and are familiar to voyagers along the coast-line from Brisbane south and west to Geraldton in Western Australia. The largest and most widespread is the Wandering Albatross (*Diomedea exulans*), which in its first plumage is dark-brown with a white face, but gradually becomes whiter as it grows older, till it assumes a plumage entirely white except for the black tips to wings and tail. In this species the span from the tip of one wing to that of the other is usually between 10 and 11 feet. Smaller forms of albatross, known to sailors as mollymawks (originally the Dutch name for the fulmar petrel), may be distinguished by the fact that the dark coloration of the wings extends right across the back. Four kinds are common in Australian waters; one of them, the White-capped Albatross (*Diomedea cauta*), nests in numbers on Albatross Island in Bass Strait—the only locality in Australia where albatrosses are known to breed. The two species of Sooty Albatross (*Phoebetria*) also visit Australian waters. They are more slender than the other kinds, dusky in colour with a white ring round the eye, and regarded as the most expert fliers of the family. W.B.A.

Albizzia, a genus, chiefly tropical, of the family Leguminosae, consisting of trees or shrubs with mimosa-like foliage, usually known as 'tongue pods,' and sometimes mistaken for wattles. The flowers occur usually in globular heads, their elongated stamens (white or pink) forming a conspicuous feature. The Western Australian *A. lophantha* is a useful fodder-plant; its dried roots contain about 10 per cent of saponin. *A. procera* (Tree-coma of the aborigines of the Northern Territory) exudes a dull, horny-looking gum, the soluble portion of which is clear and almost colourless. The tree has a close-grained, easily-worked timber resembling walnut; it seasons well, and is used for agricultural implements, bridges, and houses. In India tea-planters use the wood for stakes, and occasionally for tea-boxes. *A. Thozetiana* and *A. toona* both supply useful timbers.

Alder-flies. See MEGALOPTERA.

Aleurites, a genus of plants of the family Euphorbiaceae, contains only a few species, mostly natives of tropical Asia and Malaysia. One species, *A. triloba* (Candle-nut Tree), is found in Queensland—where it reaches a considerable size—as well as throughout the northern tropics from India to the Hawaiian Islands. It has 3-lobed leaves, and produces a number of large, spherical, fleshy fruits with a hard, almond-shaped, bony stone. The kernel is edible, in flavour somewhat like the common walnut, but rather rich; oil constitutes 50 per cent of its matter. The South Sea islanders string these stones upon a reed, or strip of palm-leaf, and use them as torches; they will burn for hours with a steady light. The oil is very fluid, of an amber colour, without smell and readily saponifiable; it has been used for candle-making, and is considered equal to rape oil. The cake, after the oil has been expressed, is good cattle-food.

Alfalfa. See LUCERNE.

Algae. Australia, owing to its extent and situation, provides a remarkable epitome of this interesting group of plants. Of simple structure, reproducing themselves rapidly by simple means, they appear in great numbers where the environment is suitable. The majority luxuriate on the margins of the sea, but vast numbers live in fresh or stagnant water, while others grow on moist soil, in damp crevices of rocks, or on the bark of trees—everywhere, indeed, where they can find enough water to live in. As an ocean-lapped island Australia is admirably adapted for the growth of marine algae; as an island of continental dimensions, with its northern shores in the tropics and its southern shores in the colder temperate zones, it possesses a wonderful variety of seaweeds proper. In the rivers and creeks of the fertile coastal districts and scrub jungles, freshwater and forest forms appear, dwindling sadly towards the dry interior.

By a rare chance the colour of algae is associated with special reproductive characters, so that members of the four great sub-divisions are in general easily recognized. The algae are classified as Blue-green (Cyanophyceae or Myzophyceae), Green (Chlorophyceae), Brown (Phaeophyceae or Fucoideae) and Red (Rhodophyceae or Florideae). The habitats of the four groups are in general diverse. The Cyanophyceae abound on the slime of mud-flats; the Chlorophyceae live in fresh water or in a narrow fringe round the seashores, usually confined to the strip between tidemarks; the Brown weeds are almost exclusively marine, growing at somewhat greater depths than the Green; while the Red weeds, also almost exclusively marine, prefer fairly deep water. Thus Green weeds may be observed coating the upper parts of piles and wharves, while masses of Brown weeds are attached below. The brighter Red weeds are more rarely observed while growing, and appear chiefly when thrown up on the shores by storms. They are best obtained by dredging.

The Cyanophyceae consist of single cells, or of colonies of such cells, or of strings of cells forming filaments. The filaments may be straight or sinuous, and in the latter case are often crowded together in a tangle. Some have pseudo-branches, the branches not growing directly from cells of the main axis but lying in position alongside it. A few are truly branched and form cushion-like masses or tiny bushes. Almost all are furnished with sheaths that develop a gelatine-like substance which encloses the filaments, binding them together in lumps of various shapes. Many possess a peculiar and unpleasant odour. In a Nostoc which sometimes appears in millions in ponds the filaments are like tiny corkscrews with many turns, the cells are of a bright yellow colour, and the odour is unbearable. Other olive-coloured Nostocs occur as little lumps of jelly on paths or meadows after rain. The Oscillatoriae form blackish-green skins covering mud or dark-coloured floating masses. Some species grow in hot water. These plants possess the property of spontaneous motion, the whole filament moving like a worm or snake. Their odour, too, is often offensive. Some of the pseudo-branched genera, as *Scytonema, Tolypothrix, Stigeonema* and some of the branched genera, as *Calothrix,* are very beautiful objects under the microscope, and are the most highly developed members of the group. These are mostly found on rocks in running streams, though some *Calothrix* are marine. The Cyanophyceae show no sexual form of reproduction. The cells divide, the daughter cells separating or remaining attached to form the filament. Certain cells or groups of cells grow larger than the others and persist to form the origin of the next season's growth. The colour of the plants is due to the admixture of green chlorophyll with a bluish pigment (phycocyanin) and occasionally other pigments.

The Chlorophyceae or Green Algae are more conspicuous. They live in fresh or in salt water. The freshwater forms are very varied. The species of Coleochaete appear as small disks closely attached by the whole lower surface to the leaves or stems of aquatic plants like *Vallisneria, Triglochin* or *Nitella.* Each plant branches out in one plane from a centre, forming a rosette; each of the vegetative cells is furnished with a long bristle. It reproduces asexually by moving ciliated spores (zoögonidia) and sexually by oöspheres (germ-cells) and antherozoids (sperm-cells). *Oedogonium* consists of unbranched filaments attached at the base, usually to the submerged parts of water-plants. The filament consists of a chain of cylindrical cells, which grow lengthwise in a curious way. The cellulose wall at the apical end splits in a circle, thus allowing fresh growth to prolong the cell. This may occur five or six times, so that the cell appears to be crowned by the cellulose caps cut off from it. Sexual reproduction is effected in certain of the cells, sometimes singly, sometimes a string of them in order, which become oöspheres. These are fertilized by active antherozoids, produced in male cells of the same or of other filaments. When ripe, the swollen yellow or brown oöspores are very conspicuous. As the vegetative cells die away, the oöspores are set free, sink to the mud at the bottom, and rest until the next season summons them to germination. A large number of species occur in Australia. *Bulbochaete* is very nearly allied to *Oedogonium,* but is constantly branched.

The Protococcoideae comprise the two families, Volvocaceae and Palmellaceae. The Volvocaceae include the colonies of *Volvox, Eudorina* and *Pandorina,* so well known to microscopists. Those of *Volvox* may contain as many as 12,000 cells. The colony swims freely as a globe, rotating by means of the cilia of the surface cells. Often eight or more smaller spheres, young colonies, are seen in the interior of the mother sphere. The colonies are reproduced by antheridia and oögonia. In *Eudorina* the cells are 16 or 32. In *Pandorina* the cells, 8 to 64 in number, have each a red spot and two vibratile cilia. The Palmellaceae are mostly unicellular plants either isolated or combined in families, the cell imbedded in a firm mucilage. They rapidly reproduce by fission and hence are often found in great numbers in water or in damp places. Such are the various species of *Palmella, Pleurococcus* and *Protococcus.* In *Scenedesmus* the cells are cylindrical, 2 to 16 ranked side by side in a single series, the end-cells often prolonged at the extremities into a narrow awn. *Pediastrum* forms small flat disks, the forked cells radiating from the centre, often with interspaces left between the cells. The most beautiful of these coenobia or family groups of cells are those of *Hydrodictyon,* which form delicate green nets which float freely in clear water and may attain to a length of two feet or more. Most of the Protococcoideae are cosmopolitan.

Among the most attractive freshwater Green

Algae are the Conjugatae, with the families Zygnemaceae and Desmidiaceae. In both, the plants increase either by bipartition of the cells, or quasi-sexually by the conjugation of two apparently similar cells. The result of the conjugation is a zygote, a single cell which surrounds itself with a thick firm wall and then rests till another season. The walls of the ordinary vegetative cells form mucilaginous outer layers which render the plants glairy to the touch. The chlorophyll-bearing portions of the protoplasm (the chlorophores) are strap-shaped, more or less spirally disposed, or are star-shaped. In Zygnemaceae the cells are cylindrical, attached end to end to form simple unbranched filaments. In *Mougeotia* the chlorophores are axile and straight. In *Spirogyra* they are parietal and usually wound round in several spiral turns, one, two or several such spiral bands occurring in each cell. The filaments float freely and often in such numbers as to form conspicuous green clouds in the water. *Spirogyra* hunters are often, however, liable to disappointment in their quest, for there are several other filamentous algae, such as *Conferva, Rhizoclonium* and *Zygnema*, which form similar clouds, and in one season certain species of *Spirogyra* may abound in a particular pond or stream and in the next may be entirely absent. *Spirogyra* fruits in the late spring or summer, the plants turning yellow when the operation is near completion. The chlorophores in *Zygnema* are much branched, the rays spreading outwards in starwise fashion.

The Desmidiaceae comprise a few genera, such as *Desmidium* and *Hyalotheca*, in which the cells form filaments included in a gelatinous sheath, and a large number of genera in which the cells are quite distinct and float separately in the water. Each cell is symmetrical about a median longitudinal plane and also with regard to another median plane at right angles to the axis of growth. There is generally a circular constriction of the cell in the latter plane, which divides it into two more or less well-marked semi-cells. Hence most of the Desmids appear to be double. In the filamentous forms the cells are cylindrical, but in the free forms the shapes taken are extremely diversified. Some appear as long rods. In others the semi-cells are urn-shaped, spindle-shaped, ellipsoidal, spherical, hemispherical, and crescent-shaped. The surfaces are smooth or crenate, tuberculated, or with projecting stellate outgrowths, which are sometimes very complicated. Two cells conjugate by laying themselves with their axes at right angles to one another; a process grows out from the middle of each, these unite with one another and form a spherical space in which the zygote is formed. It then appears as a cell with thickened walls, quaintly surrounded by the empty semi-cells of the parent plants, all the protoplasm of which has been used up in the formation of the zygote. In the filamentous forms the cells usually separate before the process of conjugation. The commoner and most noteworthy genera of free Desmids are *Closterium* (falcate or lunate), *Penium* (straight, cylindrical or fusiform), *Docidium* (cylindrical, truncate), *Cosmarium* (orbicular), *Euastrum* (oblong with sinuous borders), *Micrasterias* (orbicular, the margins radiating in much divided processes) and *Staurastrum* (orbicular in profile, with tri- or pluri-angulate apices and radiating horn-like processes). *Closterium, Penium* and *Docidium* are but slightly constricted, whereas the semi-cells in the other named genera are attached only by a narrow isthmus. A peculiarity in some of the Desmids is the presence of definite small spaces in the apices, occupied by tiny dancing corpuscles.

The Ulvaceae supply the commonest green weeds of our seashores. Attached to rocks and stones they luxuriate in the quieter waters of our harbours. They furnish the vegetation prized by molluscs and fish, and doubtless, at a pinch, would serve as useful human food. They are entirely membranous without stalks or veins, and are composed of cells rich in chlorophyll. The common sea-lettuce, called *Ulva lactuca* by Linnaeus, is actually used as a vegetable. *Ulva* grows in broad leaf-like expansions; the cells of the frond are arranged in two layers giving to it a fair amount of consistency. In *Monostroma*, some species of which grow in fresh water, the frond is composed of a single stratum of cells. In *Enteromorpha* the membrane forms a tube, rounded or flat. *E. linza* is a handsome species, growing to two feet in length, with fronds two to four inches wide, much resembling the narrow forms of *Ulva*, but distinguishable by its tubular structure. *E. intestinalis* and *E. compressa* are much used for bait by fishermen. *Enteromorpha* is often carried on the bottom of ships from one quarter of the world to another. Many of the Ulvaceae are cosmopolitan. In all the cells divide and group themselves in pairs or fours. In *Ulva* reproduction is effected by biciliate unwalled zoögonidia; one of these may be formed out of the protoplasm of almost any cell of the frond and escapes by a pore in the surface; two zoögonidia unite to form a 4-ciliated zygote, which swims to a resting-place and later grows into a new plant. Among allied forms are *Conferva*, simple unbranched filaments, forming tangles in fresh or stagnant pools, *Draparnaldia* and *Stigeoclonium*, branched freshwater forms, *Chaetophora*, forming small jelly-like masses attached to aquatic plants, and the family Cladophoraceae. In this family we have *Chaetomorpha*, simple filaments attached to rocks or to other algae, often growing close together like grass blades—but in *C. Darwini* forming strings of large glistening round cells like necklaces of pearls; *Rhizoclonium*, also unbranched filaments, often floating in tangles in both fresh and sea water, a few colourless hooked rhizomes distinguishing it from *Conferva;* and *Cladophora*, much-branched filamentous plants, each branch a row of cylindrical cells. Some of the Cladophorae live in fresh water and more in the sea. The former are slender moss-like plants, the latter present a great variety of form and colour. Some form stiff cushions growing closely to the rocks, or may be found floating in spongy balls. Some Victorian and Tasmanian species, a foot in length, form graceful plants as they spread and wave in the water. *Microdictyon* grows in sheltered bays in warmer waters; the dark-green fronds, consisting of an elegant network of branching cells, may spread to a foot or more in diameter. It is common, summer and winter, in Botany Bay. *Struvea*, found in Western Australia, forms erect fans with pinnate branches.

In the interesting order Siphoneae we have the remarkable phenomenon of a single vegetative cell taking on the form of an entire plant often of elaborate contour. The protoplasm is continuous from end to end of the plant, from the rhizoids, which attach it, to the tips of the branches. Instead of possessing a single obvious nucleus, the nuclear matter is distributed in tiny granules which are difficult to identify, requiring high powers of the microscope and special re-agents. Sexual generation is met with in some

genera; but in the most highly-developed genus of all, *Caulerpa*, long under observation in all parts of the world, no organs of reproduction have ever been detected. *Vaucheria* consists of simple or sparingly-branched filaments, which usually form thin green carpets on moist soil; it produces antheridia and archegonia. *Acetabularia* is marine; it has a vertical axis which bears whorls of speedily deciduous sterile branches below, and at the apex a whorl of club-shaped branches which make a little cup. In the branches of the cup numbers of asexual spores are formed. *Polyphysa* is a somewhat similar marine form, but the fertile apical whorls are rounded vesicles which do not form a cup. *Bryopsis*, also marine, is much-branched, the upper branches beautifully pinnate, giving a graceful feathery appearance to the plant. *B. plumosa*, is the commonest species, and is abundant in calmer waters around our coasts. Reproduction is effected by means of zoögonidia. The contours of *Caulerpa* forecast those characteristic of many higher groups of plants. *C. parvifolia* has slender branches having apparently ordinary petiolate leaves; *C. sedoides* resembles a stonewort, *C. taxifolia* a yew branch, *C. Sonderi* (shown on Plate v. fig. 1) water milfoil, *C. Browni*, *C. Muelleri* and *C. hypnoides* simple or branched club-mosses, and *C. cactoides* a fleshy cactus. *C. complanata* is shown as fig. 3. There are many kinds of *Caulerpa* in the seas around Australia, and doubtless more will be discovered by the trawl. *Codium* has flourished excessively in our seas. All the species have a spongy structure, the filamentous branches and branchlets finally terminating on the surface in club-shaped end cells which constitute a soft pile. The frond may be laminar (*C. laminarioides*), dichotomous (*C. Muelleri*, *C. galeatum*, *C. mucronatum*, *C. tomentosum*), globular (*C. mammillosum*, *C. Bursa*) or an irregular spongy mass (*C. adhaerens* and *C. spongiosum*). *C. mucronatum* and *C. tomentosum* form the dark green, almost black clumps of finger-like fronds often seen in exposed rock-pools and passages between reefs. *C. galeatum* is a handsomer species, growing to a length of two to three feet in deeper water. *C. adhaerens* forms a dark green dense mass clinging close to the rocks and following all the irregularities of the rock surface. Reproduction is effected by zoögonidia produced in certain of the club-shaped superficial tips of the branches. *Halimeda* has fronds apparently composed of joints, usually incrusted with carbonate of lime and in consequence very brittle when dried. The branches spread out in fans or fingers, the whole plant, like *Codium*, having a somewhat convex appearance. It is a tropical genus, and has played a very considerable part in the building of the so-called coral reefs and islands.

The Brown Algae are, with trifling exceptions, entirely marine. They are in general of much firmer texture than the Green, and include all the largest kinds of seaweeds. The floating weeds of the Sargasso Seas consist of the fronds of *Sargassum*. Most, however, of the Brown weeds are found on coasts of the temperate and subarctic zones, where they abound. On the coasts of Britain and France the numerous *Fuci* and *Laminariae* yield the harvests of kelp, used for manure. The largest kelps of Australia likely to be of commercial importance are found on the coasts of Victoria and Tasmania. The Brown Algae, apart from the considerable nitrogenous content of the plants, contain in their substance potassium, chiefly as chloride, but also as iodide. Kelp was formerly the chief source of iodine, and will always be a reserve source, when the mineral deposits have been exhausted. Potassium is more generally required than iodine, because of its importance as a food constituent of land crops. The power of selecting potassium and rejecting sodium compounds is seen in the composition of the efflorescence of crystals which appears on the dried weed. If the weed be washed in fresh water to remove any adhering salts of the sea water, and then slowly dried, it becomes coated with white crystals as of hoar frost. On analysis these crystals are found to consist of a compound of about 60 per cent of potassium chloride and 40 per cent of mannitol (mannite), without a trace of sodium chloride. The author found precisely the same composition in efflorescences on New Zealand and New South Wales kelps of quite different genera. Hence the value of abundant and accessible growths of kelp weeds. There should be a future for an important kelp industry in both Tasmania and New Zealand.

Quite a number of the larger Fucoideae produce floats which, often mistaken for berries, really serve to buoy up the heavy plants, maintain a more or less erect growth, and bring the fronds to the light. *Cystophora*, *Cystophyllum*, *Phyllospora*, *Hormosira*, *Macrocystis* and most of the *Sargassa* produce these floats, those of *Macrocystis* being very large. The floats are formed out of tissues at first solid; a hollow gradually appears, extends, and is filled with gas. This gas consists mainly of nitrogen and oxygen, but not in the same proportions as in ordinary air, or in the air dissolved in the sea water. If analysed in the daytime, after the plants have been exposed for some hours to the action of light, no carbon dioxide can be detected, but only nitrogen and oxygen—the latter in less proportion than in ordinary air, and far less than in the gas which can be collected by boiling sea water. If analysed in the early morning, after the plants have been for some hours in the dark, a percentage of carbon dioxide is found, and the percentage of oxygen is reduced. It seems clear that the gas is prepared by the plants themselves, and is not merely absorbed air. Considering the composition, and especially the free nitrogen, it seems probable that the chief source of the gas is a mixture of gases dissolved in the sea water. The weeds obtain all their food supplies from the surrounding sea water. They reject certain salts—as sodium chloride—and it is probable that the weeds which do not form floats reject the nitrogen dissolved from the air. Plants which do form floats make use of the nitrogen as the chief component of the gas of the vesicles. The origin of the oxygen is more difficult to settle. It may be derived from the oxygen dissolved in sea water, or from the splitting up of the carbon dioxide by the chlorophyll of the plant-cells. The variation in the amount of carbon dioxide shows that the latter source, the metabolism of the plant, is not excluded; but most likely the bulk of the oxygen is what is left over when the plant has taken all that it needs from the gas-laden water which it has absorbed.

There are over 160 species of *Sargassum* recognized, of which about one-half are met with in Australian seas. They are much-branched plants with slender stems which bear leaf-like organs. The fruit appears in high summer near the extremities of the branches as small fusiform or cylindrical receptacles arranged in cymes or racemes. The reproductive organs occur in tiny

recesses (scaphidia) hollowed out in the surface of the receptacle and communicating with the exterior by a pore. Each scaphidium contains a single oösphere or racemes of antheridia. Several genera of the family Sargassaceae are endemic, or at most extend to New Zealand. *Sargassum, Cystophyllum,* and *Turbinaria* are widely distributed in the tropical seas, but most of the Australian genera are confined to the south. The most important are *Seiroccus, Scytothalia, Cystophora* (fig. 11) with 21 species, *Scaberia* and *Phyllospora.*

The Fucaceae, which predominate in the cold waters of the northern hemisphere, have but few representatives in Australia. The only genera with us are *Hormosira, Myriodesma* and *Xiphophora. Hormosira Banksi* grows in clumps of simple or dichotomous fronds in rock-pools or in the surf. Each branch looks like a necklace of rugged brown bead-like segments which may be globular, cylindrical, or obconical, apparently strung on a very slender cord. Each segment, when mature, is hollowed out in the interior and serves as a float. The scaphidia are developed in the surface of the segments, male and female on different plants. While in the northern *Fucus* the number of oöspores in an oögonium is eight, in *Hormosira* the number is four. *Myriodesma* has flat fronds with no vesicles; the scaphidia are scattered over both faces of the frond and are hermaphrodite. *Xiphophora* is a stiff-looking dichotomous plant with narrow linear segments; it has no floats, and the oögonia, as in *Hormosira,* contain four oöspores.

The Durvillaceae form a small family, of which *Durvillaea* is sub-antarctic and the other three genera, each possessing but one species, are outliers. The three are strikingly unlike in external appearance. *Sarcophycus* is the giant of our seaweeds, with stems stout enough for the Tasmanian fishermen to moor their boats to, and irregularly divided broad leathery fronds which may reach a length of 30 feet. Such a plant is attached to the rocks by a disk six inches in diameter, and grows in the wildest turmoil of the breaking waves. *Splanchnidium* consists of clumps of short brown tubular slimy fingers, not more than six inches long and usually shorter, growing on the rocks along exposed sea-fronts. *Notheia* is a much slenderer branched form, which lives as a true parasite and usually selects *Hormosira* as its host. It is the only known parasitic alga in Australia. The scaphidia in the Durvillaeaceae are scattered over the surface of the frond and each contains several oöspores.

The Dictyotaceae are plants of no great size which grow in fan-shaped or lobed flat fronds, often zoned, striated or fenestrated from the rectilinear arrangement of the cells, and reproducing chiefly by means of asexual tetraspores which appear in patches (*sori*) on the fronds. *Padina* forms curled and concentrically zoned fronds, glistening in the water in peacock hues, and spreading in fans or cowls from a dense hairy base. *Zonaria, Gymnosorus* and *Homoeostrichus* have flat zoned fronds, spreading in fan-shaped or crenate lobes. *Dilophus* and *Dictyota* have dichotomous fronds without any midrib, while *Haliseris* has larger similar fronds with distinct midribs.

The remaining order of Brown Weeds, the Phaeozoosporinae, reproduces by means of zygotes formed by the conjugation of zoögonidia. The families and genera are very diversified in form. *Adenocystis, Ecklonia* and *Macrocystis* are our representatives of the family Laminariaceae, so widely distributed in the northern hemisphere. *Adenocystis* is a small Tasmanian plant which grows as an inflated ellipsoidal sac on a short stipes. *Ecklonia* (fig. 13) spreads out in a multitude of broad pinnatifid fronds often prickly with marginal spines. It is smoother in the harbours, but very rough and prickly when growing on the ocean front. It is our commonest Laminarian, growing on the eastern, southern and western coasts in profusion, forming thickets in water a few feet deep. In *Macrocystis* long strap-like leaves are borne on one side of a slender stem, each leaf petiolate with a float at the apex of the petiole. The terminal segment is broad and splits off new leaves in succession. Near Cape Horn *Macrocystis* grows to a length of many fathoms, and is comparable in mass to a forest tree; but with us the length of the stem rarely reaches 30 feet.

The Sporochnaceae comprise a number of elegant plants, adorned with plumes composed of tufts of filaments. *Bellotia* and *Encyothalia* are peculiar endemic forms, each consisting of a single species. *Bellotia* (fig. 9) grows as a solid slim cord, repeatedly branched in an umbellate fashion and bearing heads of plumes which surround the sporangia; it is from one to two feet in height and of a dark olive-brown colour, the tufts of filaments being greener. It is found in Bass Strait. *Encyothalia* has a cord-like stem with lateral branches of about the same length and colour as *Bellotia.* Stem and branches are beset with thin setaceous ramelli crowned with a dense pencil or plume of very slender filaments. It is confined to Western Australia. *Sporochnus* is a beautiful genus, the plants more delicate than in the other two genera; much-branched, of a greenish olive colour (it may easily be mistaken for green seaweed) and with each fertile twig crowned by a plume of very fine filaments. Australia is the headquarters of the genus.

There are many genera of Chordariaceae in our seas—*Eudesme, Bactrophora, Myriocladia, Mesogloia, Liebmannia*—which grow out in long glairy vermiform fronds, with a longer or shorter pile all over the surface.

Encoeliaceae include a number of vesicular genera. *Asperococcus bulbosus* looks like a string of sausages. *Colpomenia* is irregularly globular and may grow to the size of a man's head. It is complained of as an oyster-thief, growing on young oysters, and, as it inflates, rising in the water and floating off with the mollusc.

Other common genera of the Phaeozoosporinae are the small feathery species of *Ectocarpus* and *Sphacelaria.*

The Red algae are much richer in species than the Brown. They are almost exclusively marine; a few species of *Batrachospermum* and *Chantransia,* however, live in fresh water. There is a sexual reproduction of greater complexity than in the other groups, and an asexual reproduction by means of tetraspores. The details of the reproduction serve to divide the Florideae into more or less natural groups. The tetraspores arise from single cells, which divide into four spores which are arranged characteristically in the different genera, in a tetrahedron (triangular), or side by side in a column (zonate) or in a plane separated by two partitions at right angles (cruciate). The Red algae present a great variety of contours and are often objects of great beauty; they provide food supplies for marine animals but are of little use to man.

Porphyra lives on the rocks at the border of low tide. Its fronds are shaped much like those of *Ulva.* They are of an olive-green colour when growing, but turn purple when dried. *Gala-*

Drawn by P. Flockton Clarke.

1. *Caulerpa Sonderi.*
2. *Plocamium procerum.*
3. *Caulerpa complanata.*
4. *Hypoglossum serrulatum.*
5. *Martensia elegans.*
6. *Asparagopsis armata.*
7. *Dasya villosa.*
8. *Claudea elegans.*

9. *Bellotia criophorum.*
10. *Apjohnia lactevirens.*
11. *Cystophora uvifera.*
12. *Thurctia quercifolia,*
13. *Ecklonia radiata.*
14. *Phaeclocarpus alatus.*
15. *Chrysymenia uvaria,*

raura is tropical and subtropical. The fronds are dichotomous and consist of chains of oval or oblong cells, compressed at the joints and usually incrusted with carbonate of lime. Hence the weeds look like coarse corallines. In *Wrangelia*, on the other hand, the fronds are graceful branching filaments of a beautiful feathery form and of various shades of red or purple. The fruits (cystocarps) appear at the tips of the branches as clusters of free spores surrounded by a whorl of terminal filaments. Australia is the principal seat of the genus. The stiff, bushy species of *Gelidium* would probably yield a useful vegetable gelatin.

Some of the kinds of *Iridaea, Gigartina* and *Kalymenia* form wide red or purple laminae of considerable size, very conspicuous objects in the heaps of storm-tossed weed, but growing in deep water beyond the reach of ordinary collectors. *Callophyllis* and *Rhodophyllis* form also beautiful fronds, often flattened, much-branched or dissected in our plants. *Rhabdonia* is an extensive genus with many filiform (stringy) branches, mainly Australian, with two or three outlying species. *Catenella, Bostrychia* and *Caloglossa* are small wiry plants, which often grow above high-water mark in bays, where they are only occasionally moistened by the spray. There are several species of the widely distributed genera *Gracilaria, Hypnea* and *Rhodymenia*. *Erythrocolon* is dichotomous with strings of shining ovate, red bead-like segments of considerable size. *Plocamium* (fig. 2) has its centre in southern seas and has several Australian species. The fronds are slender and much-branched, finally pinnate (the pinnae alternate in pairs, threes or fives) and are among the favourites of collectors. *P. hamatum*, with recurved hooks among the branches, occurs on Norfolk Island and on the opposite shores of Queensland, but all the other *Plocamia* live south of this latitude.

Among the Delesseriaceae are glorious species of *Martensia* (fig. 5), *Nitophyllum* and *Hypoglossum* (fig. 4), but *Claudea elegans* (fig. 8) is probably the most gorgeous of our seaweeds. Harvey called it the most beautiful alga of the world. The frond consists of a stout axis growing in the shape of a sickle and having on its convex side a lamina made up of an open network, 10 to 12 inches long and an inch across. From the concave side of the axis branches arise which grow into plumes similar to the original, while from the concave edges of these branches other smaller plumelets spring in their turn, the whole plant presenting a striking design of a compound feather with a bold sweep to one side. Cystocarps and tetraspores are produced in the crossbars of the network. *Claudea* is found in the Tamar estuary, in Western Port in Victoria, and more rarely in Western Australia.

Among the many other attractive Florideae we may specify the family Rhodomelaceae, with many endemic forms, such as *Dictymenia* and *Lenormandia*, besides a great many kinds of *Polysiphonia* and *Dasya* and their allies. In *Polysiphonia* the joints of the filamentous axis are made up of cylindrical cells placed side by side, and giving a striped appearance to the stem. *Dasya* (fig. 7) presents rich deep red plumes, most graceful in the water. The genus has its headquarters in Australia. The Rhodomelaceae are of a darker red than most other families; the cystocarps are urn-shaped and the tetraspores are borne in flat strap-shaped stichidia.

The Ceramiaceae include many of our most delicate seaweeds. They are much-branched, with fine rami and ramuli of a bright red colour, and often grow as epiphytes on larger algae. The ultimate ramuli at least consist of single cells growing in line, and when fertile bear cystocarps and tetraspores, and present a fairy-like structure under the microscope. The oospores are surrounded by a transparent envelope, not naked as in *Wrangelia*. The tetraspores have also a transparent envelope in which they are included. The most common genera are *Griffithsia, Callithamnion, Spongoclonium, Antithamnion, Spyridia* and *Ceramium*.

Lastly we may mention the Corallines which are so abundant on the rocks near low-water mark, *Amphiroa, Cheilosporum, Jania* and *Corallina*. They secrete carbonate of lime, and when dry become bleached and brittle, but are of a beautiful rosy colour when growing vigorously in their boisterous habitat.

Most of the Australian seaweeds are endemic. A very few, such as *Ulva lactuca, Enteromorpha intestinalis, Codium tomentosum, Plocamium coccinceum, Dictyota dichotoma, Champia parvifolia* and *Corallina officinalis* are found abundantly in the seas of the northern hemisphere. The isolation of Australia has been so prolonged as to have given time for differentiation of species and genera on a large scale, and the development of such marked forms as *Claudea, Cliftonaea, Notheia, Bellotia* and *Encyothalia*. Climate (i.e. the mean temperature of the water) seems to be the main factor determining the present distribution. The bulk of the species seem to have originated in the south, occupying Tasmania, finding a paradise in Bass Strait, and spreading east and west along the Australian coasts. Some, as *Delisea pulchra*, have travelled both ways, dying out as they approach the warmer subtropical waters; but mostly the eastern and western species are not identical. The northern shores have, on the other hand, been populated from the sea to the north of them. Quite a number of species are common to Malaysia, northern Australia and Polynesia. Some of them, as the forms of *Eu-Sargassum*, dwindle and disappear as they approach colder waters. At about the latitude of Caloundra, in Queensland (27° S. lat.), we find adventurers from both south and north meeting, and neither seem able to pass much beyond this point. Curiously, in Botany Bay, we find *Hypoglossum serrulatum* and *Gracilaria textorii*. The former is only known from this locality and Japan. The latter had been supposed to be confined to Japan. These are remarkable as giving direct evidence that there has been a migration from some northern region into Australian waters.

A.H.S.L.

Allen, George (1800-1877), son of Dr. Richard Allen, physician to George III., was born in London in November 1800. He arrived in Sydney in January 1816, served his articles with Frederick Garling, crown solicitor and clerk of the peace, and was enrolled as a solicitor on 22 July 1822—the first to be admitted by the supreme court of the colony. An attempt was made to exclude him from practising, but the judges held that he had equal rights with attorneys admitted by the English and Irish courts. In 1842 he was elected an alderman of the first Sydney municipal council, and in 1845 was its mayor. In July of that year he was nominated to a seat in the legislative council of the colony, which he held until its abolition in 1856; he was then nominated to the new legislative council for a period of five years, and at its expiration became a life-member of the council, resigning in 1873. From 1856 to 1873 he was its chairman of

committees. He was all his life much interested in education. He helped to found the Sydney College, and sat on its governing body from 1828 to 1877; he was one of the first members of the denominational school board, and on its abolition by the public schools act of 1866 was appointed to the council of education, on which he sat until 1873; in 1859 he was elected to the senate of the university of Sydney, and held the position till his death. He was also a prominent member of the Wesleyan-Methodist body, for which he built a church at the Glebe. He died at his home, Toxteth Park, Sydney, on 3 November 1877.

Allen, Sir George Wigram (1824-1885), son of George Allen (q.v.) was born at Surry Hills in Sydney on 16 May 1824, educated at William Cape's school and at the Sydney College, articled in 1841 to his father, and in 1846 admitted a solicitor of the supreme court of New South Wales. Like his father, he took much interest in education. From 1853 to 1866 he was a commissioner of national education, and in 1873 succeeded his father on the council of education, as he did in 1878 on the university senate. He was also for many years a trustee of the Sydney grammar school. On 25 May 1860 he was nominated to the legislative council of the colony. He was a member for the Glebe in the legislative assembly from December 1869 until August 1883. When at the end of 1873 a department of justice and public instruction was created by Sir Henry Parkes, he was put in charge of it, and held the portfolio until the Parkes ministry resigned in February 1875. He then became speaker of the assembly, holding that office from March 1875 to November 1882. In 1870 he was elected president of the incorporated law institute of New South Wales. He was a vice-president of the royal commission for the Sydney international exhibition of 1879, and of the New South Wales commission for the Melbourne international exhibition of 1880. He died at Toxteth Park, Sydney, on 23 July 1885.

Allen, Sir Harry Brookes, born at Geelong in 1854, was educated at the university of Melbourne (M.B., 1876; M.D., 1878; B.S., 1879), where in 1881 he was elected lecturer, and in 1882 professor, of anatomy and pathology. In 1906 he took the separated chair of pathology, and held it until 1924; the museum of pathology at the university is of his creation. From 1898 to 1923 he was a member of the university council. In 1888-9 he presided over two royal commissions, one enquiring into the sanitation of Melbourne, the other (an intercolonial one) into the plague of rabbits in Australia. In 1890, during a visit to Europe, he persuaded the general medical council in England to recognize medical degrees conferred by the university of Melbourne. In 1908 he was president of the Australasian medical congress. When in 1912 Edinburgh gave him the LL.D. degree, the honour was explicitly stated to be due to his 'outstanding position in medical science and devotion to those public purposes for which Universities exist.' Serious illness compelled him to retire from active work in 1924. (Kt. Bach., 1914.)

W.A.O.

Alligators. See Crocodiles.

Allport, Morton (1830-1878), born at West Bromwich in Staffordshire, was brought by his parents to Tasmania in 1831, trained for the law, and admitted a solicitor in Hobart. His interest, however, was concentrated on natural history, and he made it his business to send to the best authorities in England or elsewhere specimens of every new fish he could procure. His preparation of a descriptive list of Tasmanian fishes was interrupted by a comparatively early death. He took a leading part in the introduction of salmon and trout (q.v.) into Tasmania; he also introduced the white waterlily, and that very doubtful blessing, the English perch, which luckily has not thriven so well in Tasmania as in some mainland waters. He died in 1878.

T.D.

Alpacas. In 1844 the British consul at Arica in Peru was requested to send 16 alpacas to England for Queen Victoria. The day after their exportation General Ygain (prefect of Tacna) stopped a consignment intended for Germany, appealed to the Lima government, and procured a decree of congress (April 1845) prohibiting the export of alpacas from all ports of Peru. Charles Ledger, who had lived in Peru since 1836, determined to get some alpacas out of the country for Australia; he therefore in 1848 rented an estate on the frontiers of Bolivia and Peru, and by 1851 had succeeded in forming a flock of more than 600. Leaving Valparaiso on 24 December 1852, he visited Victoria and New South Wales, where the importation of alpacas had already been publicly advocated—especially by Thomas Mort in 1850—and satisfied himself that the country from Twofold Bay northwards was admirably adapted for the alpaca. Returning to South America, he spent five years in accumulating in northern Argentina, mainly by smuggling them over the Bolivian border, more than 1000 llamas, alpacas, vicunas and crossbreds. The account of his operations reads like a romance; 200 of the flock were lost in one snowstorm; mules and donkeys were frozen to death; two shepherds fell over precipices, and more than 200 animals were lost by drinking the waters of a leech-infested lake in the Calchaquies valley. In July 1858 322 animals were shipped at Caldera in Chile on board the *Salvadora;* and on 28 November 276 animals were put ashore in Port Jackson and placed in the Domain. In April 1859 the flock numbered 292—46 male alpacas, pure-bred; 38 female alpacas, pure-bred; 9 alpaca lambs, born in the colony; 110 female llamas; 43 females cross-bred between alpaca and llama; 40 cross-bred lambs; 1 female and 4 male vicunas; 1 male llama, carrier. At the instance of Charles Cowper, then premier, the New South Wales government purchased this flock (which had very much improved since its arrival) for £15,000, and transferred it first to Liverpool and then (though Ledger reported that the Monaro country was most suitable) to Arthursleigh near Goulburn. Before leaving Liverpool about 200 were shorn; about 6 cwt. of wool was obtained (alpaca, llama and cross-bred) valued at from 15d. to 2s. 2d. per lb.; but the price obtained in the market only reached 9d. to 1s. 6d. per lb., as the staple was too short, due to too early clipping.

This, however, was not the first introduction of alpacas to Australia. The Victorian parliament in 1856 boldly asked the Queen for some from her flock, but was told that there were none left in England. Titus Salt of Bradford (the pioneer of the alpaca industry in England) sent two small consignments to South Australia—one flock of four to Adelaide in March 1857, consigned to his nephew Haigh of Port Lincoln, and two male and three female alpacas in July 1858 to Matthew Moorhouse of Riverton. Ten

animals (llamas and crossbreds) were also shipped to Sydney in June 1858 by G. A. Lloyd of London, and sent on to Moreton Bay, while 23 others from the same herd were shipped by Wilson, Westgarth, and others to Melbourne in February 1859, in which year also Ledger sent 19 from the flock in his charge to be tested at the Melbourne zoological garden. In 1861 the New South Wales flock had increased to 417, and the small Melbourne flock to 45, and in the Sydney exhibition of that year the most interesting exhibit, according to the press of the time, was 'a group of stuffed alpacas facing the entrance.' A similar exhibit (if not the same) was despatched to the London exhibition of 1862, and created great interest among English manufacturers. About this time, too, a Peruvian merchant obtained from his government a concession allowing him to ship 1500 alpacas to New South Wales. The first consignment, shipped by the *Julia Farmer* from Cobija (then the port of Bolivia—it is now in Chile), reached Sydney on 4 September 1863, but it seems also to have been the last. For alpacas were falling out of favour. The drought of 1862-3 killed off 200 of the government flock: Ledger quarrelled with his superior officers, and went back to South America: and the remainder of the flock was distributed among various landowners, who found that the animals, being larger than sheep, required more food than they did, whereas the hair, though valuable, was less so than merino wool. Further, scab had broken out in the flock, and even when in good health it required more looking after and humouring than sheep did: after all, the alpaca's natural habitat is from 14,000 to 16,000 feet above the sea, and acclimatization in the lower and warmer lands of Australia must have been a difficult task under the most favourable conditions. The industry therefore died out.

Alstonia, a small genus of the family Apocynaceae, consisting of trees or tall shrubs with a milky juice, dispersed over tropical Asia and Malaysia. The leaves occur in whorls of 3 or more; fruit a pair of narrow, cylindrical follicles, with numerous flat seeds attached by their sides, bearded with long hairs. The seven indigenous species all occur in eastern Australia. *A. constricta* (Bitter-bark or Fever-bark), ranging from New South Wales to Queensland, is a coastal plant in northern New South Wales, but extends to the arid interior. The wood is pale yellow. The thick yellowish-brown bark is intensely bitter, is valuable as a febrifuge and tonic, and is quoted in London drug-lists; a decoction is sometimes sold in Australia as 'bitters.' It is said to have been used by English brewers of pale ale, as it does not produce certain ill effects ascribed to hops. It tastes very like cinchona bark, and somewhat resembles in its properties both quinine and strychnine. It has been used in the earlier stages of typhoid fever with considerable success. A yellow dye of various shades is also obtained from the bark. *A. scholaris,* from northern Queensland (the Dita-bark of India), has proved a valuable remedy in chronic diarrhoea and the advanced stages of dysentery. Its light wood is used in Ceylon for making coffins. Planks of the timber, covered with sand, were formerly used as tracing-boards in Indian schools; hence the specific name.

Bitter-bark.

Alt, Baron Augustus Theodore Henry (1731-1815), born in 1731 of Hanoverian parents, after a distinguished career in the British army (ensign, 1755) served in France (1758) and Germany (1760), and at Gibraltar (1781) during the siege; helped to raise the Manchester Volunteers in 1777 and three Swiss chasseur regiments for the East India Company's service in 1781; was appointed surveyor of lands for New South Wales under Governor Phillip—possibly because he had been an engineer of roads in the Scottish Highlands in 1763—and accompanied Phillip in the First Fleet. He laid out the settlements at Sydney and Parramatta, and surveyed most of the earlier land-grants; but age and constant ill-health soon incapacitated him from active work. As early as 1791 he was applying to be relieved of his post; in 1797 he retired from active duty, and in 1802 was officially retired on half-pay. The rest of his life was spent at Parramatta, where he died on 9 January 1815. His monument, with an inscription full of biographical details, is in the Anglican cemetery of that town. Its statement that Alt was at the battle of Minden (1759) seems to be incorrect, as he himself states (*H.R.N.S.W.* iv. 347) that he went to Germany in 1760. His title of baron derives from Hesse-Cassel.

Alunite, a hydrous sulphate of aluminium and potassium, valuable both for its alum contents and

as a source of potassium sulphate to be employed in fertilizers. Australian alunites always contain a proportion of sodium, and rather more water than the European and American types. Probably the most remarkable deposit of this mineral known to exist is at Bullahdelah in New South Wales, where it composes a large part of a low ridge, and has been sometimes described as a 'mountain' of alunite. The bulk of the ridge is, however, of such poor quality as to be commercially worthless, and the high-grade ore has to be hand-picked. The mineral is quarried, and the best quality exported to Runcorn in Cheshire to be converted into alum and aluminium sulphate; but the manurial value of its potash contents makes it probable that a local industry will eventually be established to exploit them. In South Australia the mineral occurs at two places, Carrickalinga Head (40 miles south of Adelaide) and Warnertown near Port Pirie. At the former place the deposit is exceptionally pure and easily worked, and its product has been both used locally for the contained potash and exported for its alum. The Warnertown deposit has not yet been commercially developed. Deposits have been discovered in the North-east Coolgardie and Kalgoorlie areas but have not yet been exploited. From Bullahdelah between 1890 and 1922 55,000 tons were exported; the export from Australia for 1922 was only 280 tons, valued at £950.

Amaryllidaceae, a family of bulbous or fleshy-rooted plants, widely distributed and most abundant in dry, sunny countries. Seven genera, containing 26 species, are indigenous.

Doryanthes is an endemic genus of 2 species.

Darling Lily.

Giant Lily.

D. excelsa (Giant Lily, the Gymea of the Illawarra aborigines) bears a dense globular head of flowers, surrounded by a series of green floral bracts, on the top of a tall flower-stem rising from the centre of a tuft of leaves 3-4 feet long. It ranges coastally from Jervis Bay to Queensland. In *D. Palmeri* the flowers are not strictly terminal, but arranged in clusters on one side of the (usually) curved spike. The inner side of the flowers of *D. Palmeri* is almost pure white. It ranges from the northern rivers of New South Wales into Queensland. The leaves of these plants are a mass of fibre of great strength. Sir Thomas Mitchell (q.v.) obtained a medal at the Great Exhibition of 1851 for ropes manufactured from Gymea fibre.

The genus *Crinum* ranges over tropical and southern Africa and Asia; it consists of bulbous herbs with basal leaves (flat or channelled), the flower-stems rising from them and bearing a cluster of large showy white flowers. Eleven species are indigenous to Australia. *C. flaccidum* (Darling Lily) is a handsome plant that grows plentifully near the Darling River, but has a far wider range, extending from Western Australia through northern Australia to Queensland. The bulbs yield a fair proportion of arrowroot. *C. pedunculatum*, a larger and stronger-growing plant, is commonly cultivated in gardens. It ranges along the coasts of New South Wales and Queensland.

Amphibia. In a broad sense this word is sometimes applied to any air-breathing animal, such as the hippopotamus or the crocodile, which habitually enters water, but technically the Amphibia of to-day include only frogs, toads, newts, salamanders and their allies—cold-blooded animals in which there is a marked difference between the young and the adult. With a few exceptions, the young live in the water and breathe by gills, but are subsequently transformed to lung-breathing land animals; thus they are in several respects intermediate between fishes and reptiles. In Australia we have no representatives of the worm-like, limbless amphibians (Apoda), or of the tailed amphibians (Urodela) of which salamanders and newts are well-known members. There are, however, about 60 species of Anura (frogs and toads).

The typical frog is smooth-skinned, slender-bodied and long-legged; the toad is characteristically clumsy, with short legs, and a warty and usually dark-coloured skin. The variations in different families are so great, however, that distinctions cannot always be made. Certain relatives of the typical frogs are very toad-like, and some species of so-called toad families outwardly resemble frogs. Both frogs and toads are often spoken of as batrachians.

In Europe and America it has been noted that frogs have definite spawning times and regular breeding habits, but in Australia interesting adaptations to local climatic conditions have been recorded by J. J. Fletcher and others. Except in certain coastal species, the spawning season is not confined to a definite period of the year, but is largely dependent on the rainfall. It is possible to meet with frog-spawn during any month of the year, should climatic conditions be favourable. This adaptation to the irregular rainfall is particularly noticeable in inland districts. In time of drought several species of frogs are able to hibernate in burrows below the surface. Some species before retiring literally fill themselves with water, and are thus able to keep themselves alive for a lengthy period. When the drought breaks they reappear. Ova deposited by the females are fertilized by the males, and very soon tiny tadpoles are seen swimming in clay-pans which, several days before, were completely dry and seemed absolutely devoid of life.

Most female frogs deposit their ova in water, after being embraced (sometimes for several hours) by the male. At breeding times the male frog often has on its fingers rugosities which enable it to hold its partner tightly; their pressure apparently assists the female in voiding the ova, which come into contact with the seminal fluid of the male after expulsion. In many species the eggs are laid in masses, surrounded by a soft jelly. The embryo, when it emerges, mainly consists of a large head and body, without limbs. External gills are usually present in the early stages. A long tail is next developed; subsequently limbs bud out, the gills degenerate, and the tadpole rises occasionally to the surface to breathe by means of its lungs. The tail does not drop off, but is gradually absorbed from within. This process of development is subject to some variation in different species. The toadlets known as *Pseudophryne* deposit their ova, not in water, but in cavities under stones and debris in damp places. Should the weather be unfavourable, their development may be retarded—even for three months, according to Fletcher; this explains the sudden appearance of small tadpoles after heavy rain. Considering their small size, many frogs are capable of making a remarkably loud noise. The males of some species have a dilatable vocal sac, and when this is in use the region of the throat has a curiously distended appearance. Apparently the skin of many batrachians is sensitive to changes in the atmosphere, and their croaking is often regarded as a portent of rain.

Frogs have many enemies. They are devoured by rapacious birds, or fall victims to the common black and other snakes. When seized by a snake, a frog may puff itself out to an abnormal size to prevent being swallowed, but usually in vain. Further, some species are infested by the larvae of certain dipterous insects. Because of their insect-eating habits frogs and toads are decidedly useful. Certain species will make sudden hops in order to catch prey. Insects, should they come within reach, are generally caught by a quick forward movement of the tongue. Examination of stomach-contents shows that various insects are eaten; some toads also devour earthworms and snails; but it has been observed that tadpoles of common species of frog will not feed on the larvae of mosquitoes.

Remarkable stories have been told of frogs or toads said to have been found in holes, far below the surface, that have been exposed by quarrymen and others. Some of these stories may have a basis of fact, as certain species have a habit of creeping along crevices or down holes and burrowing for a short distance. It has been proved by actual experiment that toads will live for over a year when sealed up in a block of limestone; when left for two years they were found to be dead.

Australian frogs and toads may be divided into five distinct families:—Ranidae, typical frogs; Engystomatidae, the so-called narrow-mouthed toads or frogs; Cystignathidae (or Leptodactylidae), including several burrowing

Fig. 1.

frogs; Bufonidae, typical toads; and Hylidae, including the tree-frogs. The distinctions between these families are based on structural details, which cannot be comprehensively dealt with here. It may be noted, however, that in

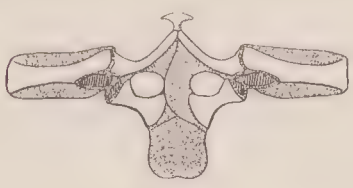


Fig. 2.

the first two families the cartilages which terminate the coracoids in the pectoral girdle are relatively small, and firmly unite in a median bar (Fig. 1). This is called the 'firmisternal'

type. In the remaining three families the terminal cartilages are more developed, and overlap each other (usually right over left); this type is called 'arciferous' (Fig. 2). When the skulls of Ranidae, Cystignathidae and Hylidae are examined, a row of tiny teeth may be seen on the upper jaws; and most frogs have short series of teeth on the borders of the vomers, which are small bones in the roof of the mouth. In 1922 G. K. Noble gave important reasons for merging the Cystignathidae into the Bufonidae.

Only two species of Ranidae have been recorded in Australia—*Rana papua*, a large frog from the Cape York Peninsula, which is also found in Papua and the islands of Torres Straits, and is probably an immigrant from the north; and *Rana daemeli*, which has the same distribution. In 1912 the late D. B. Fry described three species of Engystomatidae from northern Queensland under the generic name of *Austrochaperina*. This was the first record of members of this family in Australia, although they were known to be abundant in Papua. These frogs are said to feed on termites. In the Cystignathidae we have a number of common frogs, some of more than passing interest. The Great Barred River Frog (*Mixophyes fasciolatus*), found on the eastern coastal regions of New South Wales and southern Queensland, is our largest frog, the head and body together measuring up to four inches, and the hind-legs to nearly twice as long. The legs are marked with black bars. There is a dark band above on the snout; this seems to provide protective coloration when the frog is hiding, with only the top of its head exposed among debris in shallow pools by the edges of mountain creeks. There are nine species of *Limnodynastes*, some of which are very handsome, with dark markings on the back and the legs; one bears the specific name of *ornatus*. *L. tasmaniensis* and *peroni* are well-known forms.

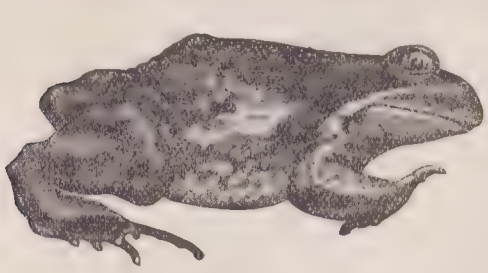


Fig. 3.
Limnodynastes dorsalis.

L. dorsalis is a very common frog, found from Cape York to Tasmania, as well as from east to west (Fig. 3); several varieties have been described. A light vertebral line is often present on the back of this frog. McCoy states that it feeds at night on spiders; and it has been known to devour a small frog of a distinct kind. In common with several other members of this family, it is a burrower, and is often dug up from the ground. The most remarkable burrowing species is the Water-holding Frog (*Chiroleptes platycephalus*), the habits of which have been described by Sir Baldwin Spencer. When found below the surface of clay-pans in the central districts in times of drought, the frog is sometimes swollen almost to a spherical shape with water swallowed before hibernating. The aborigines eagerly search for these frogs in order to secure the water. During a drought they are dull-coloured, but in the rainy season are alert and marked above with yellow and light green mottlings. In burrowing frogs a strong shovel-like tubercle is usually developed on the inner side of the metatarsals of the hind foot. *Helioporus pictus* is a smaller frog with similar habits, found near Melbourne, as well as in the central districts. On the eastern coastal regions *Adelotis* (*Cryptotis*) *brevis* is often common. The writer has frequently found it in open suburban drains, as well as on the hillsides. Looked at from above, this frog (or toad) would be considered very ugly; but its lower surface is highly-coloured, with deep orange and black-and-white markings. The genus *Crinia* contains a number of small species, some found under logs and stones. The active little Brown Froglet (*C. signifera*) is often common about Melbourne and Sydney.

The typical toads (Bufonidae) are almost cosmopolitan, but the genus *Bufo* is not represented in Australia. A curious member of this family is the so-called Catholic Frog or Holy Cross Toad (*Notaden bennetti*), on whose back a somewhat irregular cross is formed by a series of black raised warts on a greenish background, with orange and whitish spots; the coloration is probably of the warning type. This frog is known to feed on white ants. It grows to about one inch and a half in length, and when handled gives off an unpleasant yellow secretion, which renders it objectionable. *Pseudophryne* includes several species of toadlets; the commonest is *P. bibroni*, found under logs and stones in New South Wales, Victoria, Tasmania and Queensland. The upper surface is warty, the body marbled below with black and light markings. This toadlet has the habit of pretending to be dead when placed on its back. Reference has already been made to its special breeding habits.

There are over 20 species of Hylidae. Although this family is known as tree-frogs, by no means all our species are arboreal. In typical species the fingers and toes end in prominent circular disks, which are useful as adhesive pads. The giant of the family, a frog found at Hayti, has disks about the size of a threepenny piece. Many of our frogs are protectively coloured, wearing a shade of green which corresponds with their usual environment. Some show remarkable variations in colour. We have seen specimens of *Hyla peroni* which were quite stone-grey above when settled on a light material; when moved, they assume a brownish-olive tint. This species, which is not so large as the common green tree-frog, has a very harsh croak; it has the habit of hiding in the recesses of hollow posts.

Two large *Hyla* species frequently met with are *H. caerulea*, the common Green Frog, and *H. aurea*, the Green-and-gold Bell-frog. The former is a large species, with extensive webs between both fingers and toes; it was named *caerulea* because specimens preserved in spirit showed a bluish tint, but in life it is light green above, often with white spots on the sides. In Queensland this frog is common in gardens, and at night often enters houses and becomes quite tame if not molested. It is fond of cockroaches. Sometimes it travels up drainpipes, and reveals its presence by loud and persistent croaking. *H. aurea* is typically found near swamps, and is a powerful swimmer. Some specimens are beautifully marked with green, gold, blue and white. When about to hibernate, it may be almost black. Its fingers, unlike those of *H. caerulea*, are free from webbing. Apparently it does not extend

to the northern parts of Australia. The males have two vocal sacs, which distend at each side. They are said to devour small frogs in preference to insects.

H. ewingi is a widely distributed and very variable frog, and specimens have been obtained even near the summit of Mount Kosciusko. Sometimes it is quite white, and varies from this to dark brown. Many *Hyla* species are very slender in form, with pointed heads, and the disks terminating the fingers are small. One of these, *H. nasuta*, is a light olive-brown frog with raised longitudinal markings on the back, a blackish band on each side of the head, and the thighs marked with a black band edged with yellow. *Hylella bicolor* (sometimes called *Hyla fallax*) is a tiny frog sometimes seen in the reeds surrounding pools of water, but so protectively coloured, and so compactly settled on the reeds, that a casual glance may not discover it. It has also the power of assuming distinct tints. The Hylidae and Cystignathidae are numerously represented in South America as well as in Australia, and their presence in both countries is often adduced as part of the evidence in support of a former Antarctic land connection.

A large number of frogs have been recorded from Papua, and the wet climate of that country evidently favours their development. Several are closely allied to, or identical with, certain Australian species, but the majority are related to oriental forms. *Hyla* is well represented; a common species bears the name *H. macgregori*, after the well-known administrator. The Engystomatidae are the most numerous, and there are several species of *Rana*. It is of interest to note that a giant form of the Ranidae is found in the Solomon Islands.

See G. A. Boulenger's *Catalogue of Batrachia Salientia* (1882) in British Museum Catalogues; H. A. Gadow's *Amphibia and Reptiles* (1901), vol. viii of the *Cambridge Natural Histories;* Lucas and Le Souef's *Animals of Australia* (1909); G. K. Noble's *Phylogeny of the Salientia* (1922); and papers by J. J. Fletcher in the *Proceedings* of the Linnean Society of N.S.W., and by D. B. Fry in the *Records of the Australian Museum.*

H.A.L.

Anacardiaceae, a family of trees or shrubs abundant in tropical (rare in temperate) regions, with six indigenous genera and 10 species; flowers small. *Rhodosphaera* (*Rhus* of von Mueller) *rhodanthema* (Yellow-wood) is a tree of 70-80 feet, with dense pyramidal sprays of small pink to crimson flowers, growing in the brush forests of northern New South Wales and Queensland. The wood is soft but durable, and takes a fine polish; an acid ingredient of the sap prevents it from burning easily. A yellow dye has been obtained from it. *Euroschinus* is an endemic genus limited to one species, *E. falcatus* (Maiden's Blush Wood), a large tree (140-150 feet) of the coastal brushes of New South Wales and Queensland, whose timber somewhat resembles cedar. The genus *Spondias* is chiefly tropical. *S. Solandri*, found in north-eastern Australia, is a tree of moderate size, with a hard rough timber. See SEMECARPUS.

Anchovy. An Australian anchovy (*Engraulis australis*) is so similar to the European species as to be distinguishable only with difficulty. It occasionally occurs in enormous shoals off the coasts of New South Wales, Victoria, and Tasmania, and its range extends to south-western Australia, southern Queensland and New Zealand. Though abundant at certain seasons each year, it is not utilized commercially. A number of tropical fishes of the genus *Stolephorus*, allied to the anchovy, have been found in Australian waters, but little is recorded of their occurrence. They differ from the typical anchovy in having a firm skeleton, and are therefore less valuable than the southern species. A.R.McC.

Anderson, JOSEPH (1790-1877), born in Sutherlandshire, Scotland, on 1 June 1790, at the age of 15 entered the army (ensign, 1805; lieutenant, 1808; captain, 1821; major, 1826; lieutenant-colonel, 1841) and served in Italy during the campaign of Maida (1806), in Egypt (1807), in the Peninsula (1808-12) and at the capture of Guadaloupe (1815). In 1826 he became a major in the 50th foot, and sailed with his regiment for New South Wales in 1833, reaching Sydney on 2 March 1834. At the moment news had just been received from Norfolk Island that another of the many convict risings was in progress, and Anderson was hurried away within ten days of his arrival to act as commandant on the island. He took severe measures to restore order, and for the five years of his rule the island was orderly. Towards the end of his term the British parliament was giving much attention to the conditions under which transportation was being carried out, and Anderson's severity came in for condemnation—though Bourke specifically commended his 'humane but firm and vigilant superintendence.' Also, the type of convict sent to the island was altered—since 1826 it had been used for 'twice-convicted' prisoners (i.e. those who, coming as convicts to New South Wales, were again convicted in the colony of serious crime), but in 1839 it was decided that convicts under an English sentence should be sent straight to the island. It was therefore decided to replace Anderson with Alexander Maconochie (q.v.), an advocate of very mild discipline; but, as Anderson's regiment was being recalled in 1839 for service in India, he was at once relieved by the temporary appointment of Major Bunbury, Maconochie taking up his duties some time later. Returning to active service in India, Anderson gained distinction at the siege of Gwalior in 1843. In 1848 he retired on half-pay and migrated to Victoria; there he was in 1852-6 a member of the nominee legislative council, and for many years after maintained an active interest in questions of defence and of Chinese immigration. He lived for nearly 30 years on Punt Hill, South Yarra, and gave his name to a street there. He died on 18 July 1877. (K.H., 1838; C.B., 1843.)

See his *Recollections of a Peninsular Veteran*, posthumously published in 1913.

Angas, GEORGE FIFE (1789-1879), youngest son of Caleb Angas, coach manufacturer and shipowner, was born at Newcastle-on-Tyne on 1 May 1789, apprenticed to his father's business in 1804, and made a partner in it about five years later. In 1824 he started a branch of the shipping business in London, which in 1826 became an independent firm; but in 1831 the whole of his father's business again fell into his hands, except the coach factory, which had been taken over by an elder brother. In 1832 Angas was approached by the founders of the South Australian Land Company, and—influenced by his study of the life of William Penn—became a member of its provisional committee. This company failed to win government approval; when, however, two years afterwards the

South Australian Association (see SOUTH AUSTRALIA) was formed, Angas joined the board of commissioners, and it was almost entirely by his personal exertions that the subsidiary company's capital was raised. Becoming a director of the company, he resigned his commissionership, and again by his personal and active persistence succeeded in despatching to Australia on 22 February 1836 the first shipment of settlers. In the same year he helped to found the South Australian School Society to provide education for the settlers' families. The subsequent financial troubles in which the new colony became involved made it necessary to send his son, John Howard Angas, to South Australia in 1841; and in 1850, although two years earlier he had found himself compelled to resign his seat on the board of directors, he decided to migrate to and settle in South Australia. It is noteworthy that the date of his departure was approximately fixed by the passing, on 5 July 1850, of the act that gave a constitution to the colonies of Australia; 'now that the Bill has passed' he wrote in his diary, 'I feel that my work is done here, at least as regards South Australia.' Travelling by the *Ascendant*, which also took to the colony the official copy of the constitution act, he reached Adelaide in January 1851.

Once in the colony, he settled at Angaston in the Barossa district, which had already been greatly developed by J. H. Angas. In August 1851 the district returned him unopposed as its first representative in the legislative council; and he retained his seat there, and in the council of the bi-cameral legislature that succeeded it, until 1866, when he retired from practically all active public life, though maintaining control of his private business and interest in public affairs until his death. He died at Angaston on 15 May 1879.

So far nothing has been said of his numerous philanthropic activities—beginning with the Benevolent Society of Coachmakers which he originated in 1807, before he was of age, and ending with the Angaston Recreation Park which he opened at the end of 1878—or of his many public (and especially financial) achievements. The following is a mere catalogue of the more important work coming under each head. Always a firm supporter of Christian missions, his interest in the mahogany trade of Honduras led him in the early twenties to join Wilberforce and Zachary Macaulay in attacks on West Indian slavery; a few years later he became interested in missions to the Hindus also, and in the thirties sent out Lutheran missionaries to the aborigines of South Australia. Early in 1836 he met Augustus Kavel (q.v.), a representative of certain Lutheran congregations in Prussia who were at odds with the Prussian government about the use of a new liturgy, and were being treated intolerantly. Migration seemed the only remedy; and in 1838 300 of them sailed for South Australia in the *Prince George* and *Bengalee*, another 200 following in the *Zebra* and 120 more in the *Catherine*—all vessels provided by Angas and largely equipped at his expense. (The further history of these German migrations to South Australia is narrated under KAVEL, AUGUSTUS.) He also, after many years of planning, helped in 1832 to found the British and Foreign Sailors' Society.

His public life was concerned mainly, though not altogether, with finance. He was a co-founder of the National Provincial Bank of England (1833), the Union Bank of Australia (1837), and the Bank of South Australia (1841). In December 1838 he obtained for the colonial office the information about French designs on New Zealand that hurried on British annexation (see NEW ZEALAND)—for this service he was offered first a knighthood and then a baronetcy, but declined both. He played an important, though inconspicuous, part in the shaping of the South Australian constitution of 1850, being largely responsible both for the omission of clauses which would have established a form of federation and for the recognition of the principle that no state aid should be given to religious bodies. When established in South Australia he became a very active influence in local politics, successfully advocating high-priced land, the increased immigration of skilled labourers, and an elected upper house, while he opposed (without success) the introduction of railways, voting by ballot, and the annexation of the Northern Territory.

See Hodder's *Life of George Fife Angas* and Harcus's *South Australia.*

Angas, GEORGE FRENCH (1822-1886), eldest son of George Fife Angas (q.v.), born at Newcastle-upon-Tyne on 25 April 1822, was educated at Tavistock and intended for business pursuits. Disliking these, he studied lithography and anatomical drawing, and in 1843 went to South Australia and accompanied Sir George Grey (then governor) in many up-country expeditions, sketching the scenery, aborigines, and flora and fauna of the country traversed. Proceeding to New Zealand—which was then very little known beyond the coast-line—he similarly sketched the inland districts of those islands, and on his return to England in 1846 set about the publication of *The New Zealanders Illustrated* and *South Australia Illustrated*, both books appearing in 1847—as did a third, *Savage Life and Scenes in Australia and New Zealand.* Meanwhile he visited South Africa and obtained material for a fourth book (*The Kaffirs Illustrated*, 1849). In that year he revisited South Australia, and in 1850 made sketches of life at the gold-diggings of Ophir in New South Wales, which were published in London in 1851. In 1853 he was appointed secretary of the Australian Museum, Sydney, and held the position for six years. In 1861 he returned to England, where he spent the remainder of his life; during this time he illustrated McDouall Stuart's and John Forrest's accounts of their explorations in Australia, and wrote much both for popular and for scientific journals. He died in London on 8 October 1886.

A younger brother, JOHN HOWARD ANGAS (born on 5 October 1823), has been already mentioned as assisting his father, G. Fife Angas, in managing his South Australian businesses. Starting independently in 1853, he soon became known as a stockbreeder. He represented Barossa in the legislative assembly from 1871 to 1875, and later was elected to the council. He was a generous benefactor to the university of Adelaide, to many South Australian charities, and to Dr. Barnardo's Homes, and was a founder of the Bushmen's Club in Adelaide, president of the British and Foreign Sailors' Society (which his father had founded), and originator of the Angas Industrial Mission to New Guinea. He died on 17 May 1904.

Angel-sharks or MONK-FISH, members of the family Squatinidae, a group which is transitional between sharks and rays. The body is depressed and flat like that of a ray, and the greatly enlarged pectoral fins form an im-

perfect disk; but they are separated from the head, instead of being united with it, as in rays. Further, the gill-openings are on the side of the neck, as in sharks, instead of on the lower surface. Several species are known from temperate seas; the commonest Australian form is *Squatina australis*, which occurs in shallow waters south of the tropics, and attains a length of five feet. Another Australian species, *S. tergocellata*, is known from a single small specimen trawled in deep water in the Great Australian Bight.

A.R.McC.

Anglican Church. See CHURCH OF ENGLAND.

Angling. Under this head are discussed (*a*) sea-fishing with rod and line, (*b*) sea-fishing with hand-line, (*c*) river-fishing with rod and line.

The lack of knowledge about game-fish angling in Australia may be accounted for by the fact that few anglers have tested the possibilities of the sport in any but a superficial way. Rod-fishing in salt water has become popular only in recent years, and even now hand-lining has a great many followers. The most important 'game fish' in Australian waters are swordfish (caught off the coast of Queensland) Spanish mackerel, kingfish, bonito, tunny, and albacore, distributed along the coast from Broome south-about to Townsville. Moreton Bay and Port Stephens have been exploited more than other places; Spanish mackerel and kingfish are frequently caught there up to about 30 lb. in weight, and much bigger fish have been hooked and lost. The best bait for these 'game fish' is a fresh garfish, placed whole on the hook and wire trace, so as to swim naturally, without spinning, when trolled. For jewfish (running up to 80 lb.), black rock cod (400 lb.), sharks 12 feet and over in length, rays, and groper, dead fish-bait is the best. The smaller kingfish, tailor, barracouta, Australian salmon, and at times flathead and snapper, take a metal spoon or spinner readily, and afford good sport on light rod and tackle. For bigger 'game fish' anglers should be equipped with the kind of tackle used on the coast of North America or New Zealand.

The beaches of the Australian coast seem made for the angler, with clean, hard, tawny sand, tides rising about five feet, and pockets of blue water where the waves create an eddy. The fishing is usually best in the neighbourhood of inlets or estuaries. A cast of 30 yards should reach fish. The tackle recommended is a greenheart or built-cane rod about 10 feet long, 15 oz. in weight; a Nottingham Malloch, or multiplying reel; Japanese gut, or silk, line with thread backing; hooks to suit bait and fish; sinkers, ½ oz. to 2 oz. This tackle is suitable for whiting, trevally, sea bream running from half a pound to 4 lb. or over, jewfish, and salmon; these give the most popular sport on beaches and at river entrances. The baits used are pippies, beach-worms, prawns, crabs, and mullet or other fish-bait.

When fishing near rocks or reefs whether from shore or boat, the angler may catch snapper and groper up to 25 lb. in weight, silver drummer, blackfish, morwong, pike, and other species. Ledgering from a boat in estuaries and tidal rivers is fascinating sport among the smaller fish already mentioned. The boat must be moored stem and stern, and kept steady. Two men can use two rods each; the finer the tackle, the better the results. Float-fishing off rocks or in harbours and rivers is very popular. Skill, berley (ground bait), and cunning are needed to catch the larger bream (known as black bream and silver bream); baits already mentioned may be used. Blackfish and drummer may be enticed with 'green weed,' a kind of sea-grass that grows on piles or rocks; 'cabbage,' a seaweed which grows in little tufts on the rocks, is also used, and cunjevoi. In quiet water a quill float is best; but along an ocean coast or on rough sea-walls a long cork float is used, weighted for casting. Small hooks are needed. The tackle must be fine and strong, as both fish are determined fighters and give splendid sport on a light rod. Ebb-tide is the best period for this kind of fishing, which is the most popular form of float fishing, and would have delighted contemplative old Isaac Walton.

To those who like the 'pull devil pull baker' style of fishing, the natural bamboo pole and strong line, with or without reel, may appeal. The many sea-walls at river inlets along the north coast provide suitable hunting grounds, where with well-weighted line, and bait allowed to be still, fine bream and occasional groper and drummer are caught on small rock crabs, mullet, or other baits. A fine wire leader is almost indispensable, and the fish should be given short shift.

Sport in Tasmanian coastal waters is like that on the Australian coast, with a little variation in the fishes.

Hand-lining hardly comes within the category of angling, but must be mentioned, as it is used considerably on almost all salt-water fish. 'Black-breaming' with a fine gut line in the quiet waters of inlets is an art which requires much skill, patience, and quietness. It is best learnt by practice under experts. A dark night and a rising (or full) tide is best for this work; the swim should be well berleyed with pollard and herring or the like. Several dozen fish averaging 1½ lb. may be taken in this way. Drifting in a boat is another method of fishing for whiting, flathead, flounder, and other fish.

The most favourable months for salt-water fishing are, generally speaking, November to May (summer); the worst are August, September and October (late winter); but throughout the winter blackfish descend from the estuaries to ocean rocks, and are angled for there. Bream and tailor may be caught on ocean beaches, in the colder months, especially at night. Snapper, squire, and red bream (the same fish at different ages) are caught at that time of the year in the outer waters.

In all the States sea-fishing is controlled by government departments. Net fishermen are subject to restrictions as regards size and mesh of nets, close seasons, and sizes of fish that may be caught, but only the last-mentioned applies to line-fishing in salt waters. Besides beaches, rocks, estuaries, and sea-walls, the salt-water lagoons are attractive ground for the angler.

Atlantic salmon ova were successfully hatched out in Australia in the forties; the fry, however, never thrived. Brown trout hatched out about the same time were the original stock of our present brown trout. In Tasmania they have occasionally attained, in the Great Lake, the weight of 25 lb. Rainbow trout have been caught up to 15 lb. Lake Leake records trout of 10 lb., but the average weight is 3¾ lb. On the mainland brown and Loch Leven trout were first angled for in the Snowy River about 1900. Brown trout have held their own in many rivers of New South Wales, Victoria, and Tasmania,

though the advent of the rainbow trout (introduced from America via New Zealand about 1886) for a time eclipsed the popularity of the brown trout. The recent reaction in favour of brown trout is very marked in Victoria, where the idea had become prevalent that the two fish do not thrive in the same waters—on account of their different time of spawning, the one fish is said to prey on the ova of the other. As a matter of fact, in the Snowy, Murrumbidgee, Eucumbene, and Mowamba (all rivers of New South Wales) the two have thriven together for over 20 years; each seeks out, and remains in, the water most suited to its habits. Where the two fish are together the more vigorous rainbow frequents the rougher and cooler waters, while the brown trout occupies quiet swims and warmer backwaters—so much so that experienced anglers may to some extent select the species they wish to take. But this does not obtain in all waters, for rainbows only are found in many New South Wales streams, and only brown trout in some waters of Victoria and Tasmania. Loch Leven trout have also been introduced into some rivers and lakes, but frequently appear to have lost their characteristics and to have reverted to, or crossed with brown trout, here, as in New Zealand. American black-spotted trout and salmon-trout fry have been liberated in some streams, but have quite failed to establish themselves. In Tasmania a trout (probably the brown) descends to the estuaries. Rainbow trout have been caught in Australia up to 12 lb. in weight, but there is no authentic record of brown trout of that weight. In individual fish the rainbows top the scales, especially in slow streams such as the Bigbadja (New South Wales) or in some streams when they are first introduced, such as the tributaries of the Murray River. In the Snowy River though there is on record a rainbow of 9 lb. 2 oz., one of 5 lb. is now a rare fish, and a brown trout of 4 lb. unusual; yet the average brown trout is heavier than the average rainbow, and is a less capricious fly-taker though a less vigorous fighter. The average fish caught weighs about one pound. Trout also thrive in lakes in Tasmania, Victoria, and New South Wales—e.g. the Great Lake and Lake Leake in Tasmania; Wendourie and Katani in Victoria; the Burrinjuck dam and dams near Kiandra in New South Wales. The principal trout rivers are the Mersey, Ouse, Derwent, Esk, Dee, and Shannon in Tasmania; Gippsland streams, Delatite, and Ovens in Victoria; the tributaries of the Murray on the borders of Victoria and New South Wales, and the Snowy, Murrumbidgee, Tumut, upper reaches of the Macleay, Macquarie, Barrington, Hastings, and Manning in New South Wales with their tributaries; also streams in the Federal Territory (Canberra), and wherever the altitude is over 2000 feet in the Monaro and New England districts.

Sebago and quinnat salmon have been introduced into the Tasmanian lakes recently, but it is too early to pronounce on the result. Tasmania imposes on anglers a licence-fee of 10s. per annum for trout-fishing; in Australia no licence is required. The close season in New South Wales lasts from 14 April to 30 October, varying slightly in Victoria and Tasmania. There are a few trout in small streams near Adelaide (South Australia), but in no other States. Attempts at acclimatization in Queensland were a failure.

Flies or minnows used for trout in England and elsewhere will answer just as well in Australia—'silver doctor,' 'Jock Scott,' 'Wilkinson's,' and the like for the larger fish; 'March brown,' 'coch-y-bouddu,' 'governor's,' 'Hoffland's fancy,' 'Invicta,' the palmers, duns and spinners, Irish lake-flies, etc., for trout of average size. One may fish with wet or floating fly according to fancy. Large trout are often caught with a sunk wet fly, worked as in the New Zealand lakes. English perch and tench have been introduced into some of the States.

Occasionally a snake is seen on the rivers, but there is no record of an angler having been bitten; still it is well to wear thick woollen or rubber wading stockings. The government tourist departments of the three States have under their control several good accommodation houses, notably on the Great Lake (Tasmania), at Mount Buffalo (Victoria), Kosciusko, The Creel, and Yarrangobilly (New South Wales). Elsewhere accommodation is obtained at hotels, farms, or camps—and for camping the climate of Australia is well suited.

Among freshwater fish indigenous to inland streams west of the dividing range which are worthy of the angler's attention are the Murray cod (occasionally caught over 80 lb.), Murray (golden) perch, Macquarie black perch, and silver perch; of the last three weights up to 4 lb. have been recorded, but the average is 2 lb. The first three are good table fish, but would hardly be deemed game fish. Cod readily take a large spoon bait, especially if it has a red tassel. Perch sometimes take artificial spinners; the Macquarie perch has been known to take a small trout-fly or halcyon spinner. Usually, however, these fish are taken with baits of various kinds—worms, frogs, meat, grubs, etc. Their river haunts are subject to prolonged droughts, but the fish survive in the pools, and on the advent of a flood or fresh very quickly spread themselves; it is then that the best sport may be looked for. They have great powers of recuperation, and breed prolifically. Professional fishermen make a living by trapping and hand-lining Murray cod and perch for market. In the rivers of northern Queensland there is a giant perch, often known as barramundi (q.v.). It is also caught in the brackish water of estuaries. It is a strong fighter, takes a spinner and gives excellent sport. The ceratodus (Burnett salmon) is caught only in the Burnett River in Queensland. In these rivers anglers must be wary of crocodiles. In the shorter rivers of New South Wales and Victoria, east of the dividing range, are fine perch (or bass), distinct from the perch of the inland rivers, and known to naturalists as *Percalates fluviatilis*. They occur also in the Gippsland lakes. These fish will take an artificial minnow or a spoon; but the best sport is to be had with a fly of the size used for salmon, such as a 'hornet,' 'Jock Scott,' or anything resembling an insect and kept moving. A rather stiff trout-fly rod and strong tackle should be used, as when hooked the perch bolts for the nearest log or rock. An average weight is about one pound, but fish of 6 lb. and over have been caught. In the rivers they prefer quiet eddies and backwaters.

Mullet are found in rivers inhabited by the perch just mentioned, and are caught with worms and dough. A mullet of two pounds and over puts up a great fight. A catfish is found in many coastal streams, but is prized more by the cook than the angler.

In addition to the foregoing freshwater fish, some saltwater fish (e.g. bream, tailor, and flat-

head) often penetrate a mile or two into the fresh water at the head of tidal waters; here perch may be caught with a fly and saltwater fish with baits. The much debated estuary perch, thought by some to be identical with *P. fluviatilis*, will not take a fly in salt water, and should be angled for with live shrimps or prawns. Eels are plentiful in the coastal streams, and run to a large size.

A freshwater herring abounds in some rivers, chiefly near tidal waters, and will rush at a small trout-fly; they sometimes reach a quarter of a pound in weight, but average about an ounce. Formerly cucumber mullet (*Chlorophthalmus nigripinnis*) were plentiful in Tasmanian and some Australian streams, but they have almost disappeared.

Acclimatization is controlled chiefly by the government fisheries departments in Australia and by fisheries associations in Tasmania. The tourist departments of the several States will supply information; for more detailed advice anglers should apply to the New South Wales Rod-Fishers' Society in Sydney, the Piscatorial Council in Melbourne, the Ballarat Anglers' Club, the Northern Tasmanian Fisheries Association, or other local angling clubs.

See T. C. Roughley's *Fishes of Australia*, A. R. McCulloch's *Fishes of New South Wales*, and H. Joseland's *Angling in Australia*. H.J.

Angophora, a genus of trees of the family Myrtaceae, endemic in the sandstone regions of eastern Australia, is closely allied to *Eucalyptus*, from which it is distinguished chiefly by the absence of the operculum. The calyx-tube is bell-shaped and 5-angled, the white margins of the lobes having the appearance of petals; stamens very numerous; fruit a 5-ribbed capsule. *A. lanceolata* (Smooth-barked Apple) and *A. intermedia* (Narrow-leaved Apple) yield a reddish-brown kino of a brittle nature. The timber of both species is liable to gum veins, but when free from these defects is useful, as it is hard, tough and impervious to damp, and therefore adaptable for naves and spokes of wheels, slabs and rough building material. *A. subvelutina* (Broad-leaved Apple) is lopped for stock in times of drought. Its timber is heavy and tough, takes a good polish, burns well, and contains a large proportion of potash. *A. cordifolia* (Dwarf Apple), a shrubby species with opposite leaves, heart-shaped at the base, and bristly fruits, is very ornamental. Its enormous umbels of creamy-white flowers, full of honey, attract a great variety of insects, and so yield a harvest to entomologists. *A. melanoxylon* is one of several trees known as 'coolabah,' q.v.

Dwarf Apple.

Anonaceae, a large family of trees, shrubs or woody climbers, chiefly tropical. The genus *Melodorum* has three indigenous species; *M. Leichhardtii* (Merangara of the aborigines) is a shrub with flexuous, almost climbing branches, dull-greenish flowers and oblong fruits. The berries are eaten raw by the aborigines. It ranges from northern New South Wales into Queensland. *Eupomatia* has two endemic species: *E. laurina* (Rosebush or Bolwarra), a soft-wooded shrub with glossy laurel-like leaves, has flowers with an exceptionally strong odour; this attracts certain very small weevils, whose visits bring about cross-pollination.

See the *Handbook for New South Wales* (published for the 1914 meeting of the British Association for the Advancement of Science), p. 389.

Anoplura. See SUCKING-LICE.

Anous. See GULLS, TERNS, AND SKUAS.

Antarctica. (This article deals mainly with the Australian share in Antarctic exploration.) Captain Cook associated Australia and Antarctica in history when during his second voyage, on 17 January 1773, he was the first to cross the Antarctic circle north of Enderby Land. Twelve months later he reached 71° 10' S. in a region where (as he himself foresaw) no explorer has yet gone farther. With his small sailing vessels Cook could not penetrate far into the icepack; but he conjectured that a large continent lay within it.

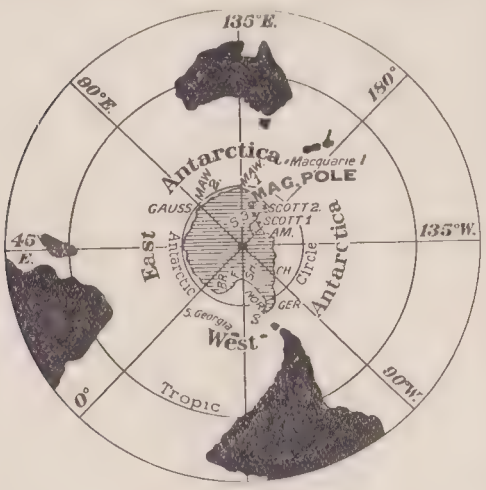
D'Urville, Wilkes, and Ross carried out explorations in 1840-2 on behalf of France, the United States and Britain respectively. They explored the coasts immediately south of Australia, the two former delineating a coast-line which was later extended by Mawson, while Ross sailed into the sea since named after him, and discovered the regions with which the names of Scott and Shackleton will always be associated. D'Urville and Ross also mapped the extension of Antarctica towards South America, where it stretches northwards to 63° S.—about as far from the equator as are the Faroe Isles in the Arctic.

For over 50 years little was done to increase our knowledge of Antarctic geography, though Neumayer urged the adventure from the time of his association (1856) with the Melbourne observatory, and his efforts led directly to the voyage of the *Gauss* in 1901. In 1894 the Norwegian whaler *Antartic* sailed south from Melbourne to prospect for whales, carrying as one of her crew C. E. Borchgrevink, who had spent some time in Australia and may therefore be described as having 'broken the ice' for Australian explorers. On 23 January 1895 a party

from this vessel (including the master and Borchgrevink) landed near Cape Adare, and were thus the first people to set foot on the Antarctic continent. In December 1898 Borchgrevink led an expedition in the *Southern Cross;* Louis Bernacchi, a young Tasmanian who had been trained in Melbourne, was his meteorologist. The ship landed a party of 10 at Cape Adare, where they built a hut and spent the winter of 1899. These men may be termed the first inhabitants of Antarctica; but, hemmed in by ice cliffs and open sea, they were unable to advance our knowledge greatly. In 1900 Borchgrevink landed on the Ross Barrier, and marched inland a short distance to 78° 50′ S.

In 1901 Commander R. F. Scott, R.N., was sent in the *Discovery* to carry on explorations in Victoria Land. The *Discovery* was especially fitted for a magnetic survey, and of this Bernacchi had charge. The German expedition under Drygalski simultaneously carried out observations at the Gaussberg far to the north-west. Scott traced the great Ross Barrier until its eastern boundary was approached at King Edward VII Land; then he returned to Ross Island, and for two years stationed his ship off the south-western slope of Mount Erebus. In November 1902 the first long sledge-journey in Antarctica was made by Scott, Shackleton and Wilson. They marched south over the Barrier for 300 miles along the base of a great range of mountains that rise at times to over 10,000 feet. In the spring Scott marched up the Ferrar and Taylor glaciers to the great inland plateau which is the characteristic feature of Antarctica. A thick carapace of ice covers the whole plateau, which rises in this latitude (78° S.) to about 8000 feet above sea-level. He reached a spot 300 miles west of his winter-quarters, having crossed the line joining the magnetic and south poles. Scott's expedition, therefore, explored the three major features of this sector of Antarctica—the great plateau, the huge outlet-glaciers, and the low-level expense of the Barrier ice.

It was now possible to estimate the general character of the new continent. In shape it closely resembles South America, and the two continents remind one of two pears placed in line with the stalks nearly touching. But



Antarctic Continent.

Antarctica is much smaller—probably about 3½ million square miles in area, or 20 per cent larger than Australia. A series of fold-mountains seems to carry the Andes into western Antarctica by way of the South Georgia loop. In the same way on its eastern side the block-fault mountains of eastern Australia are perhaps prolonged in the gigantic ranges that extend from Cape Adare almost to the Pole. The resemblance is yet more striking in that both these regions have their highlands on the coast, and the eastern scarp is much steeper than the gentle western slopes. In the Antarctic, however, instead of the low Australian western plains, there is the largest high plateau in the world. It seems to culminate near the South Pole at 11,000 feet, but falls to 8000 feet near Scott's headquarters, and to 4000 feet not far south of Mawson's headquarters.

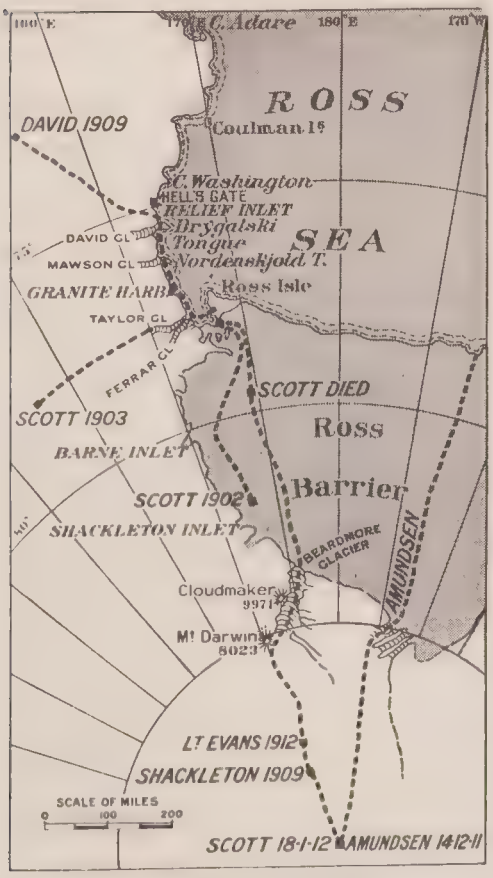
The geological formations of the Australian sector of Antarctica are akin to those of southern Australia. The basal gneisses resemble those of Eyre's Peninsula; the red and grey granites are also found in the southern States. The most southern fossils from the Beardmore glacier are Cambrian 'corals' like those of the Flinders Range, and Permian ferns allied to those of our Newcastle coal-measures. The Beacon sandstone—the chief sedimentary formation—may ultimately be shown to resemble in its later developments the late Palaeozoic and Mesozoic sandstones of Australia. Finally, the extensive dolerite 'sills,' which have penetrated thousands of square miles of sandstone, recall in many of their features the similar sills of Tasmania.

Biology seems to indicate that the old cartographers, in their delineation of a huge Antarctic continent, were only reproducing actual ancient conditions. Thus the flora and fauna of Tasmania have in some respects close affinities with South America. Geoffrey Smith writes of the temperate jungles of western Tasmania:—

> The xerophytic gums are almost everywhere replaced by evergreen myrtles or beeches, and the undergrowth attains a rankness and a density which have to be seen to be believed. There is an entire change of vegetation and scenery, so that one seems to pass right into, shall we say, Tierra del Fuego, or a lost Antarctic continent.

A genus of small coniferous shrubs (*Fitzroya*) has only two species, one confined to Tasmania and the other to South America; so also the Tasmanian wolf (*Thylacinus*) is almost identical with an extinct marsupial from Patagonia, whereas the whole of Asia (now much more readily accessible from Australia) has no recorded marsupials, living or fossil. The Antarctic land-connection, if it existed, has long vanished, but relics of it may persist in Macquarie Island and in the submarine ridge discovered by Captain Davis in 1912. When we know that the Himalayas have been elevated in comparatively recent geological times, it is easy to understand that Jeffreys Deep and the Southern Ocean generally may have developed in the same period. On the other hand most of these widespread genera go far back in geologic time; so that dispersion from a Mesozoic Asiatic centre possibly accounts for their present widespread distribution.

One of the most successful Antarctic expeditions was that led by Shackleton during 1907-8; and it is not too much to say that the Australians —Professor (now Sir) Edgeworth David and Dr. (now Sir) Douglas Mawson—shared with the leader the main honours of the struggle. Shackleton had hoped to land at King Edward VII Land, some 400 miles E. of Ross Island, but was compelled to build his hut on Cape Royds, some 20 miles N. of the *Discovery* station. In March 1908 Professor David and a party con-



Ross Sea and Barrier.

quered Mount Erebus, 13,370 feet above the sea and surrounded by the incomplete rings of three older craters, which in places project as black fangs from the white mantle of ice. At 11,000 feet they found a field of 'fumaroles,' whose steam built up huge cowls of snow and ice. On 10 March they reached the summit, and found an active crater 900 feet deep and half a mile wide. Steam explosions were proceeding from three openings at the bottom of the cauldron. The steam column has been seen to rise to 20,000 feet; but luckily the volcano was quiescent, and the lava does not seem to have overflowed recently.

Early in November Shackleton and three companions started their journey towards the pole. On the 26th they had passed Scott's 'farthest south' (82° 17′), and found that the great mountain scarp now trended E. across their path. Shackleton, therefore, ascended the Beardmore glacier—a colossal river of ice 120 miles long and often 40 miles wide—which led him up from the low Barrier ice to the plateau at 7000 feet. For nearly 200 miles they journeyed on the ice-plateau, rising gradually to 10,050 feet. On 9 January 1909, when they had reached 88° 23′ (less than 100 geographical miles from the pole), they were compelled to turn back. On their return Wild discovered coal and fossil corals on the upper Beardmore. They reached safety after experiencing extraordinary difficulties throughout a journey unsurpassed in polar annals.

Meanwhile a small party under another Australian, Armytage, had added to the geological knowledge of the western mountains. But an event ranking with Shackleton's 'farthest south' was the location of the magnetic pole by David and Mawson. Early in October 1908 this party started their hazardous journey up the coast. Only one who had experienced the peculiar dangers of sledging along an Antarctic coast with impassable glacier-walls on one side, open water on the other, and cracking sea-ice beneath him, can realize what they accomplished on this magnificent journey. For two months the small party man-hauled their sledges northwards over sea-ice until they reached the Drygalski Tongue. The peculiar feature of this coast is that the outlet glaciers, draining from the ice-plateau through the marginal ranges, send out huge floating tongues of ice into the sea. Thus the Drygalski is like a huge wharf, projecting nearly 40 miles from land. Here the party turned inland and climbed the Larsen glacier to the plateau, which near this part of the coast is about 3000 feet high. They marched on NW. towards the south magnetic pole, gradually rising until the plateau was 7350 feet above sea-level. Each day the magnetic needle dipped more and more, until on 15 January it dipped 89° 45′. Exact readings were very difficult, but Mawson calculated that 13 miles more would place them practically at the magnetic pole; accordingly next day they marched on, and Professor David took possession of the area for the British Empire. On their return, by one of the curious coincidences of exploration, they reached the coast at Relief Inlet on the same day as the *Nimrod;* for the ship had no knowledge where they would turn inland, and was cruising along looking for depots. One has only to recall what happened at the same place to Scott's northern party in 1912, to realize how near to death was this worn-out magnetic pole party in February 1909.

On 30 July 1923 a large area of the Antarctic regions, including much of the territory explored by Shackleton in 1908-9, was constituted a British dependency under the jurisdiction of the governor-general of New Zealand. The new dependency stretches from the ocean to the south pole between the meridians of 160° E. and 150° W., but does not take in the lands round the magnetic pole annexed by Professor David; this lies within an area named Adelie Land in 1840 by Dumont D'Urville (who sighted its coast, but did not land on it), and the area is nowadays claimed as French territory. On 13 December 1924 Adelie Land—defined as extending from St. Anne's Point to Rabbit Bay—was, along with the Kerguelen and Crozet archipelagoes and other French islands in the Southern Ocean, created a national park of refuge for marine mammals and penguins.

In 1910 and 1911 four expeditions entered the Circle. Of these Filchner's penetrated the Weddell Sea, in the American quadrant, and found an ice-barrier at its head resembling the Ross Barrier. A Japanese expedition landed at King Edward VII Land. Amundsen took up his quarters on the Ross Barrier at the Bay of Whales, and made a successful dash with dog-sledges to the pole. He found the plateau scarp continuing south of the Beardmore Glacier, marked by high mountains here as it is farther north. He reached the pole on 14 December 1911, just a month before Scott and his British party.

Scott's expedition, which because of his tragic

death is still the most memorable of Antarctic expeditions, was also probably the most completely organized of any; for the scientific results to be obtained were considered quite as important as the conquest of the pole, and the attainment of them was mainly left to specialists. Three members of the geology school of the university of Sydney accompanied the expedition. Priestley was Professor David's colleague on the previous expedition, and had been doing research work at Sydney. Debenham had just graduated there. Griffith Taylor, a Commonwealth official, was instructed to study especially the aspects of Antarctic geology and meteorology which bore on Australian problems. The expedition left Lyttelton in New Zealand in November 1910, and by the end of January had built their hut at Cape Evans, between the 1902 and 1907 huts. The northern party (under Lieutenant Campbell) was landed at Cape Adare, and during the first summer explored the glaciers to the north. A very complete study of the penguins and of the ice conditions was made by Levick and Priestley; Scott, meanwhile, was busy laying his depots to

MacMurdo Sound.

the south. On their return from this work three men and four ponies went adrift on the sea-ice. Luckily the wind drove the floes ashore, but three ponies were lost, in addition to others killed on the barrier.

In January 1911 the western party—consisting of Taylor and Debenham (geologists), Wright (physicist) and seaman Evans—sledged up the Ferrar glacier to its junction with the Taylor glacier. They surveyed the latter, found that it terminated 25 miles from the sea, left their sledge in an alcove in the glacier, and portaged to the sea, traversing a lake five miles long, full of algae. The ice-free valley was found to resemble closely those of the Swiss Alps, and the great rock-barrier across it (2400 feet high) is

unique in Antarctica. Returning to MacMurdo Sound, they traversed the Piedmont, sledged up the centre of the greatly dissected Koettlitz glacier, and surveyed the bare valleys below Mount Lister. These resemble in structure the clusters of cirque valleys of the Rockies, but are much larger. A subglacial stream, frequented by seals, ran for 25 miles from Heald Island to the sea. The party sledged back round the breaking barrier, and reached Hut Point on 15 March.

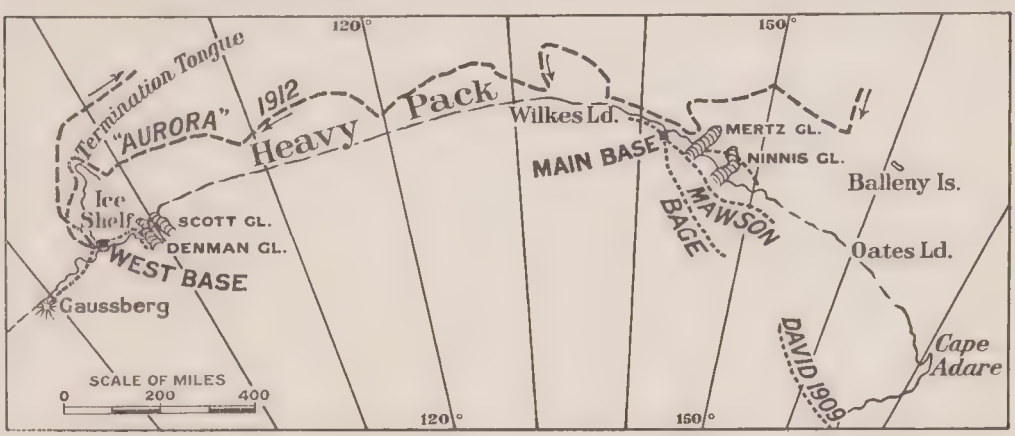
A gallant journey by Dr. Wilson, made during the depths of winter to study the emperor penguins at Cape Crozier, stands unrivalled as a test of endurance. His party was away for five weeks, sledging by the light of a candle when the moon was not visible. A temperature of −77° F., or about 110° below freezing point, was experienced. A blizzard at Cape Crozier blew away most of their gear, but they brought back embryos that gave valuable details concerning the evolution of this most primitive of birds.

On 31 October 1911, in the second summer, Scott left Cape Evans on his last journey. Motor-sledges, dogs and ponies helped him on his earlier stages to the Beardmore glacier, but south of latitude 83° man-hauling carried out all the work. The last supporting party under Lieutenant Evans left them at 87½° with their plateau journey half completed. On 16 January 1912 the British flag flew at the south pole. They found Amundsen's record, and turned back for their return journey a distance of 800 miles. Seaman Evans's accident and illness delayed them fatally. Yet Wilson collected most important fossil ferns at the head of the Beardmore, and carried them on to their last camp. After Evans died, Oates fell ill, and it was a feeble party that raced famine in the awful March cold of the Barrier. A severe blizzard destroyed their last hopes, and the party perished 11 miles from One-ton Depot—about 100 miles from Ross Island.

The second western party (Taylor, Debenham, Gran and Forde) left headquarters on 7 November 1911 for Granite Harbour, travelled up the coast for three weeks, and on arrival at Discovery Bluff—where the ship was to pick them up—built a rough granite hut. For over two months seal-meat was their staple food. The large inlet was mapped by Debenham, who found interesting minerals, including topaz. Two genera of wingless insects, the first found in eastern Antarctica, were discovered in the moss at 'Botany Bay.' The expedition next portaged its sledge up 1000 feet of granite cliff, marched up the Mackay glacier, and climbed a prominent nunatak (Mount Suess, 4500 feet). Here well-preserved fossil fish of Devonian age were discovered, and also specimens of bituminous coal. On their return to the rendezvous the ship was unable to relieve them, the pack-ice being 20 miles wide; so, after waiting a month until the food-supply ran short, they made their way back over the untraversed Wilson Piedmont glacier, and were picked up on 15 February 1912 at the head of MacMurdo Sound.

The northern party (under Campbell) had been landed early in 1912 at Evans Cove. They explored the glaciers round Mount Melbourne for some weeks, and then found that the same belt of pack-ice prevented their relief. Burrowing into a snowdrift at 'Hell's Gate,' they managed to survive the long winter night under conditions of starvation never experienced before in the Antarctic. In the spring, with two men out of the six sick, they managed to sledge over the frozen sea back to headquarters. In the last summer Priestley led a party up Erebus, and Debenham prepared a detailed survey of this most interesting volcano, while by means of sounding balloons Dr. Simpson investigated the upper air of Antarctica for the first time. Simpson and Wright carried out accurate magnetic and pendulum research on a scale not attempted on any other expedition. On one of his voyages Captain Pennell, in the *Terra Nova*, discovered Oates Land, W. of Cape Adare.

In December 1911 the Australasian Antarctic expedition left Hobart for the Antarctic, under the leadership of Dr. Mawson. This expedition was almost entirely financed by public and private subscriptions in Australia. Twenty-six men, mostly young Australian graduates, were landed at Commonwealth Bay on the Antarctic continent, while five others maintained a wireless sta-



Aurora's Bases.

tion and carried on valuable research in Macquarie Island, which lies almost half-way (900 miles) between Tasmania and Antarctica. Macquarie Island was left on Christmas Day, and the *Aurora* sailed due S., reaching heavy pack-ice off the Balleny Isles. A course was made to the west, where the ship entered the open D'Urville Sea, and a rock-girt coast was reached on ?

January 1912. Here the party landed, being the first to set foot on the Antarctic continent between Cape Adare and Gaussberg, a distance of 1800 miles. The rocky area was found to be one mile in length and half a mile in extreme width. Behind it rose the unbroken inland ice; and no similar 'oasis,' as Mawson appropriately terms it, was encountered on the whole north coast. On the 19th the *Aurora* sailed with Wild and his party to make a landing farther W. On the 24th Captain Davis sighted high land, to which Wilkes's name was given in memory of the bold American explorer of 1840. Heavy pack-ice prevented them from reaching land where it had been reported by earlier exploring ships, but Totten Land was approached within seven miles, and seems to have been wrongly described. On 8 February Davis reached 'Termination Land,' to find it a huge ice-tongue projecting from shelf-ice, 200 miles north of the continent. On the 15th the party was landed on floating ice at the western base, near what was later called Queen Mary Land, 1200 miles from Mawson's headquarters at Commonwealth Bay. The *Aurora* then returned to Hobart.

It was soon evident that the main (Commonwealth Bay) base was swept by the strongest winds ever recorded. The average wind-force for the first year proved to be 50 miles per hour (compare this with the European average of 10·3 miles, and the United States average of 9.5 miles). On 16 August the average for one hour was 105 miles. It was necessary to wear spikes or crampons on the boots in order to traverse the region at all. During the winter the infrequent lulls were employed in erecting a wireless mast, which was done by 30 September. Messages were sent out, and received at Macquarie Island, but nothing was heard in Antarctica. In October a terrific gust tore down the apparatus. On 9 November Mawson, with Ninnis and Mertz, started to explore the continent to the east. Two days were spent among the crevasses of the Mertz glacier, 50 miles E. of headquarters. Another 50 miles brought them to the Ninnis glacier, which, like the Mertz, drained to the sea down a shallow valley about 20 miles wide. Here some thrilling escapes from crevasses were recorded. On 13 December they were sledging 280 miles E. of headquarters along the Piedmont slopes and some 20 miles from the sea, where the ice is usually free from crevasses; when they do occur, crevasses in the Piedmont are especially dangerous, since one's track generally lies along their course and not across them. Mertz and Mawson crossed several safely, but on looking back found that Ninnis had disappeared. With his sledge and team he had fallen into a fathomless crevasse. Only ten days' food for the men, and nothing for the dogs, remained for the survivors. They decided to make their way back parallel to their outward track, but farther south, where the ice might be less disturbed. One by one the dogs were killed and eaten. Early in the New Year it became evident that Mertz was weakening much more than Mawson. Using a sail on the sledge, they managed to make some mileage, but on 7 January 1913 Mertz became delirious and died in the night. Mawson was still 100 miles from safety, with the crevasses of Mertz glacier ahead of him. On the 17th he fell the full length of his harness into a crevasse, and was only saved because the sledge was caught on the snow-bridge. Two desperate efforts ended in his reaching the surface. Thereafter he carried a rough rope ladder, which enabled him to climb out without such exhausting labours. On the 29th, with only two pounds of food, he came on a small depot left that morning; then he reached a cave cut out of the ice, only five miles from the hut, and there was held up by a blizzard for a week. His terrible journey ended on 8 February.

On 10 November 1912 the magnetic pole party (Bage, Webb and Hurley) started their journey to the south. After rising to 3650 feet, they descended 1500 feet into the broad valley that feeds the Mertz glacier; crossing it, they marched over the unvarying ice of the plateau, Webb recording the magnetic dip each day, and on 21 December reached their farthest south, 175 miles NW. of David's 1908 terminus. Here the dip was 89° 43.5', only 16½ minutes from vertical. The plateau was 5900 feet above sea-level, or about 1300 feet lower than David's station. They estimated that the maximum dip would occur about 60 miles south—which would fix that elusive locality, the south magnetic pole. They reached the hut on 11 January 1913, after a fine journey of 600 miles, which filled a large gap in our knowledge of the ice-plateau on this side of the pole.

On 8 November 1912 the east coast party (Madigan, McLean and Corell) followed a route parallel to Mawson's, but largely over sea-ice. Several rock islands (nunatakker) were investigated, and showed that the continent was here built chiefly of gneiss. They crossed the Mertz glacier where it was afloat and over 20 miles wide, then descended to the sea-ice and sledged across some 40 miles to the Ninnis ice-tongue; this crossed, open sea appeared to the east. Nevertheless they sledged another 80 miles eastwards—a fine performance, in view of the precarious nature of the sea-ice. In 18 December they turned to the coast, and discovered very interesting formations at Horn Bluff. Here a vast dolerite sill seems to have penetrated Beacon sandstones, just as first recorded far to the south by Ferrar in 1903. On their return journey they found great granite cliffs forming the coast-line between the Ninnis and Mertz glaciers. Shorter journeys were undertaken by other parties. Bickerton marched 130 miles W. along D'Urville's coast, one interesting discovery being that of a meteorite on the snow. Stillwell carried out detailed geological surveys within 50 miles of the hut, discovering incidentally a wealth of bird-life on the small islets of the coast. Other members of the main party were Close, Hannam, Hodgeman, Hunter, Murphy and Whetter.

The western base party (under Wild) had built their hut on the Shackleton ice-shelf, 12 miles north of the continental ice—and, curiously enough, just as far north of the Antarctic Circle. This party comprised Wild, Jones, Dovers, Harrison, Hoadley, Kennedy, Moyes, and Watson. In August 1912 they sledged E. over the ice-shelf, and laid a depot some 20 miles away among nunatakker of gneissic granite. Here also the winds were of phenomenal force, men being lifted off the ground and flung 20 feet by the gusts. Another depot party under Jones was held up by a blizzard for 17 days, without being able to strike tents. In November Wild led a party to the east, but was blocked by tremendous crevasses where the Denman glaciers entered the ice-shelf—the boundary chasm was 1000 feet wide and 400 feet deep. Jones led a party to the west for 200 miles, and at Haswell Island discovered one of the two known rookeries of emperor penguins. On 22 December the Gaussberg was reached, and cairns made by the German expedition were found. The whole party was re-

lieved by the *Aurora* on 22 February 1913. The large stretch of explored coast was given the name of Queen Mary Land. It had not been possible to pick up Mawson on his return to his base, and so a party of six remained to search for him; they carried out further scientific work, and were finally relieved by the *Aurora* on 12 December 1913.

The Macquarie Island party was in charge of Ainsworth of the Commonwealth weather service; he carried out valuable meteorological work, which was sent regularly by wireless to Australia and incorporated in the daily weather-maps. Much light was thrown on the Antarctic low-pressure systems, which largely control the rainfall of southern Australia. Macquarie Island is especially rich in seals, penguins and other forms of southern life, which were studied by Hamilton, while Blake made a detailed survey of the island and investigated the geological features. In September 1912 they received faint signals from Mawson's base, but not until 3 February 1913 were they able to send a message to Antarctica. The island party agreed to stay and maintain communication until Mawson could be relieved in the following year. Captain Davis in the *Aurora* carried out numerous soundings south of Tasmania—a very interesting discovery being 'Mill Rise' (in lat. 47° S.) where the ocean floor rises sharply from 2500 fathoms to 543 fathoms. Macquarie Island itself is really a submerged peak rising 16,000 feet from ocean depths, though its highest point is only 1420 feet above sea-level.

Yet another Antarctic expedition has special interest to Australians, for it contained three Australians (Gaze, Jack, and Richards) as well as J. F. Hurley, who had accompanied Mawson in 1911, and was to be the official photographer of the A.I.F. during the war. Sir Ernest Shackleton in the *Endeavour* late in 1914 proposed to make simultaneous attacks on the Antarctic from the Weddell Sea and from the opposite (Ross Sea) region. He hoped to land a party S. of South America and march over the plateau to the Ross Sea base; but 30 miles from land he was beaten back without landing, and his ship was sunk, though after a perilous drift on pack-ice his party was ultimately rescued. The photographic material obtained by Hurley was especially noteworthy. The other party under Macintosh was safely landed at Scott's old headquarters in January 1915; the ship was carried north, enclosed in a field of ice, but ultimately broke clear and safely reached New Zealand. The shore party (including the three Australians) was fully employed in laying depots to the Beardmore glacier. In January 1916 they laid their last depot at 84° S., but their return journey was as perilous as any in Antarctica. Spencer Smith succumbed to scurvy, and Macintosh and Hayward were temporarily left behind while the stronger members pushed on for food and help. Ultimately the invalids were brought to Hut Point, and soon recovered. On 8 May Macintosh and Hayward tried to reach Cape Evans across the sea-ice, but were lost (probably through the breaking of the sea-ice) in a blizzard which sprang up soon after. A Commonwealth relief expedition under Captain Davis rescued the survivors in January 1917.

See for the earlier voyages Mill's *Siege of the South Pole;* for those after 1900, Scott's *Voyage of Discovery,* Shackleton's *Heart of the Antarctic,* Scott's *Last Expedition,* Mawson's *Home of the Blizzard,* Taylor's *With Scott, The Silver Lining,* and Davis's *With the Aurora in the Antarctic.* Gr.T.

Anteater, Banded. See BANDED ANTEATER.

Anthocerotales. See LIVERWORTS.

Antidesma, a genus of the family Euphorbiaceae, widespread over tropical and subtropical regions. The four species indigenous to Australia range from Queensland into the Northern Territory. *A. Dallachyanum* (Herbert River Cherry) is a shrub or small tree, whose fruit (the size of a large cherry) has a sharp acid flavour resembling that of the red currant, and makes an excellent jelly.

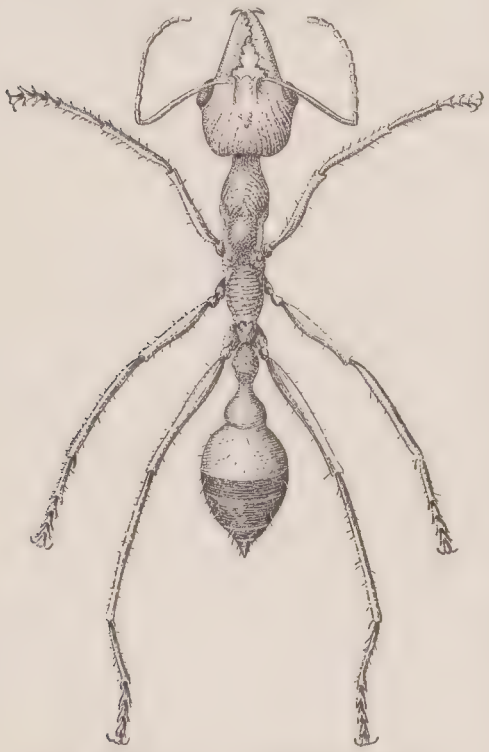
Antimony. Most Australian antimony ores contain a payable quantity of gold. Costerfield in Victoria is the largest producer in Australia, and supplies 4 per cent of the world's antimony. The other chief producers—in the past—were Hillgrove, Kempsey, and the Nambucca district, all in New South Wales, each of which had their own smelters. At the present time the only works treating antimony ore are situated in a suburb of Sydney. Here the ore, which should not contain less than 50 per cent of sulphide of antimony, is smelted direct in a reverberatory furnace with soda-ash and oxide of iron to slag off the silica, while scrap iron is added to combine with the sulphur to form an iron matte. The crude-antimony produced, which contains about 95 per cent of metal, is refined in another reverberatory furnace where the percentage is brought up to 99.5 per cent. The chief impurities in the 'star' antimony are a little tin from the scrap iron, and lead from the original ore. Antimony not infrequently occurs associated with galena (lead sulphide) in small quantities. At the Port Pirie smelters, where Broken Hill ores are treated, the antimony is concentrated as hard lead, and used in the manufacture of various lead-antimony alloys. F.D.P.

Anti-transportation League. See TRANSPORTATION.

Ant-lions, vernacular name of the insect family Myrmeleontidae, belonging to the order Planipennia (q.v.). Strictly speaking, the name 'ant-lion' applies only to the larvae of this family, which are in general short, oval, insectivorous grubs with prominent mandibles, commonly found in sandy soil or on sea-beaches, where they form conical pits. At the apex of each pit lies a single larva on the watch. Should an ant fall into the pit—or be placed in it—the larva's mandibles quickly seize it; if it struggles to climb the shifting pit-sides, the larva often flicks up sand to pelt it and bring it down within reach. The adults somewhat resemble dragonflies, with which they were formerly classified in the obsolete order Neuroptera. Their powers of flight are comparatively feeble. Australia has a large number of species, especially in the dry central districts. The genus *Glenoleon* has many species marked with black spots or bands; those of *Periclystus* (plate xix, fig. 27) are strikingly beautiful. Other common genera are *Protoplectron, Myrmeleon* and *Acanthaclisis.* See PLANIPENNIA. R.J.T.

Ants, insects of the family Formicidae, belonging to the order Hymenoptera. This family may be almost said to have its headquarters in Australia, and is undoubtedly the dominant group of insects here; its members are found everywhere from the coast to the driest parts of the central desert, and are often little short of a curse. Many species astonish visitors from other coun-

tries by their abnormal size. The most striking forms belong to the genus *Myrmecia* (Bulldog Ants, also known as 'soldier ants' and 'inchers'), the oldest known type within the family and certainly the fiercest, capable of inflicting a very painful bite and therefore dreaded.



Red Bulldog Ant (*Myrmecia gulosa*).

They are abundant and aggressive in most parts of Australia; their average length is an inch, but specimens an inch and a half long are known. Their jaws are not very stout; but they are long, and on one side irregularly serrated, so that they have a powerful grip. Bushmen occasionally make an ant fasten its jaws through the sides of a wound, and then cut off the head, which holds the gash together with its clenched jaws for as long a time as is desired. It is, however, the sting that is most painful, being often worse than the sting of a bee. They usually build a slightly elevated cone or crater in loose soil, where possible beneath a log or stone; the galleries sometimes extend several yards, and the nest may go to a depth of two feet, although usually it is less. The actual entrance to a nest is about an inch in width. Their prey consists largely of other insects, although frogs, lizards and other small creatures are killed and eaten. The larvae average almost an inch in length. They are rather narrow, and the head-end curls round; when fully-fed, they spin a pale silken cocoon.

The commonest and most aggressive species about Sydney is *M. forficata*, a reddish ant, with the tail-end blackish; it attacks on the slightest provocation, or no provocation at all, and in certain parts of the National Park almost every passer-by is certain to be stung by it. In Tasmania *M. pyriformis* is the commonest species. It has a general resemblance to *M. forficata*, but usually works only at night, when it makes several openings to the nest, and closes them again on the appearance of daylight. The Blue-black Bulldog Ant (Blue-incher), *M. tarsata*, is also common in coastal districts of eastern Australia. It is less aggressive than most species of the genus, and on being disturbed often retreats into its nest; but its sting is quite as severe as that of the others.

Jumper-ants—of which there are several kinds, all of the genus *Myrmecia*—are generally somewhat smaller and less shining than the others, and are usually black and yellow. They are rather more active and vindictive. When moving about on their ordinary business they have a very quick walk, but when attacking they proceed by a series of quick jumps, from three inches almost to a foot in length, and as their nests may have several entrances caution is needed in their vicinity. Other large but harmless ants (none of which can sting, though many can bite) belong to the genus *Camponotus; C. intrepidus* is a huge black species as big as a bulldog ant, whose nests are conspicuous in the bush. *C. nigriceps*, the large Sugar-ant, is a pest in houses. Another stingless genus is *Polyrhachis*, containing some beautifully coloured ants, of which *P. ammon* may be taken as representative. Amongst the objectionable species the Mound Ant (*Iridomyrmex detectus*) is prominent; its huge nests are particularly destructive to garden paths. This ant gives off a strong odour, and bites viciously. The somewhat smaller Green-head (*Ectatomma metallicum*) also has a reputation for biting and can also sting. One of our most interesting genera is *Leptomyrmex*, of which *L. erythrocephalus* (from the Blue Mountains) is a well-known species. These ants carry the abdomen curled up over the thorax; no queen has ever yet been discovered in any of their nests.

In the coastal regions of tropical Australia the most aggressive of all ants is the Green Tree-ant (*Oecophylla virescens*), which swarms over and savagely bites anyone who ventures to disturb its home in the foliage. Occasionally it makes its nests in orange trees, and pickers suffer severely from it; fortunately it does not sting. Dodd in 1902 thus described the nest-building of *O. virescens* in Queensland. 'It is decidedly interesting to observe the insects engaged upon the construction of their domiciles. If the foliage is large or stiff, scores or even hundreds of the ants may be required to haul a leaf down and detain it in place until secured, both operations taking considerable time. It is quite a tug-of-war matter to bring the leaf into position and keep it there. The insects holding it have a chain of two or three of their comrades fastened on to them, one behind the other, each holding its neighbour by its slender waist, and all at full stretch and pulling most earnestly . . . . When the leaf is far apart the ants form themselves into chains to bridge the distance and bring it down; many of these chains are frequently required for a single leaf . . . . several of these chains were from three to four inches long . . . . Up or along these living bridges other ants were passing. Now for the web material used to build the nests. It is furnished in fine and delicate threads by the larvae: moreover, I have only seen what appears to be half-grown examples used for the work—I have never seen a large larva being made use of. The soft and tiny grubs are held by the larger ants, who slowly move up against those pulling. Each grub is held by the middle, with head pointing forward, its snout is gently made to touch the

edges of the leaves where they are joined, it is slowly moved backwards and forwards and is undoubtedly issuing a thread during the operation, which adheres to the leaf edges, and eventually grows into the web. When this web is completed it must be composed of several layers to be strong enough for the purpose of securing the leaves.' (*Victorian Naturalist* 18, 136-140).

Besides her natural plethora of ant-life Australia has acquired certain introduced species as pests. The most troublesome is the minute reddish Pharaoh's Ant (*Monomorium pharaonis*), common in many parts of New South Wales and Queensland, and often seen on ships. No food is safe from its attacks, unless isolated by the housewife's remedy, the saucer of water with a film of oil. Another introduced species is *Pheidole megacephala*, also a minute red species, the soldiers of which have larger heads. These swarm especially in the warmer coastal districts; although always ready to carry off household food, their favourite diet consists of other insects, so that they cannot be wholly regarded as enemies. See HYMENOPTERA. For White Ants, see TERMITES.

R.J.T.

Aphaniptera. See FLEAS.

Aphides, insects of the family Aphidae, belonging to the sub-order Homoptera of the order Hemiptera. The native Australian species are few, and none are troublesome; one curious species affects the cypress pines of the mainland and the Oyster Bay pine of Tasmania. The pest-forms are all introduced species. The worst is *Phylloxera vastatrix*, the dreaded grape-vine scourge; so far this has appeared only in Victoria and New South Wales, where every vine attacked has, as soon as the presence of the pest was discovered, been destroyed. Stringent regulations are in force to prevent its introduction to the other States. In Australia, curiously enough, only the root-form is known; the leaf-galls have never been seen.

The Orange-aphis (*Siphonophora citrifoli*) is common on the orange, and the curious fumagene fungus that lives on its 'honey-dew' causes the leaves to appear coated with soot.

In some years the Wheat-aphis (*S. granaria*) damages crops by sucking the stems of wheat, so that they break down. *S. rosae* is almost universal on garden roses, and may be seen flying in great numbers in spring. This species, besides laying eggs in autumn, is also viviparous; a young rose-aphis may often be seen with beak thrust into a leaf before it has completely left the parent's body.

The Woolly Aphis (*Schizoneura lanigera*) infests apple trees—except those grown on 'blight-proof' stocks—and causes numerous galls on the roots, trunk and branches; it is occasionally seen amongst the pips of the apples themselves. An enemy of this pest has been discovered in the tiny chalcid *Aphelinus mali*. Supplies of this valuable parasite were sent in 1921 by Dr. Howard, chief of the bureau of entomology at Washington, U.S.A., to R. J. Tillyard (q.v.) at the Cawthron Institute in New Zealand; Tillyard successfully established, propagated and distributed the wasp (100,000 living individuals were sent out to orchardists during the summer of 1924-5), and woolly aphis is now well under control in all parts of New Zealand. From 1923 onwards consignments have been supplied to all the Australian States, and in Queensland and Western Australia, where distribution has been most general, good results have followed. The wasp-females lay their eggs separately in the bodies of living aphids, and the grub attains full growth by devouring its host, and pupates within the skin of the dead aphis. Four or more broods of the parasite appear in the course of a single summer. All cruciferous plants in Australia are liable to the attacks of the Cabbage-aphis (*Aphis brassicae*), which in dry seasons will destroy whole crops of cabbages or swedes. The Green Peach-aphis (*A. persicae*) and its black congener (*A. persicae niger*) greatly infest peach-trees and may considerably diminish the crop. The latter also occurs on chrysanthemums and other garden plants. Some writers classify these two species as belonging to the genus *Myzus*. See HEMIPTERA.

R.J.T.

Apium, a genus of the family Umbelliferae, containing a few widely distributed species. The calyx-teeth are inconspicuous; petals broad, with a shortly inflexed apex; fruits almost turgid, with 5 prominent ribs. The plants are herbs with dissected leaves. *A. australe* (Australian Celery) is a perennial herb which has been used as a culinary vegetable. There are two forms of this species, one found on the sea-coast with thick, obtuse, succulent leaves, and an inland form with narrow, prickly-pointed foliage. *A. leptophyllum* (Wild Parsley) a slender annual with thread-like leaves and branches, is occasionally eaten by stock. Like other members of the genus it tends to become acrid when grown in a damp place. It should be capable of improvement by cultivation. The exotic species *A. graveolens* is the common Celery and *A. petroselinum* the Parsley of the kitchen garden.

Apocynaceae, a large tropical or subtropical family of trees, shrubs or twining plants —rarely perennial herbs—with opposite (or whorled) entire leaves, usually inconspicuous flowers, and drupes or berried fruits. *Alyxia* is a small genus ranging over Malaysia and southern Asia. With one exception the seven endemic species are confined to eastern Australia. *A. buxifolia* is a low, rigid, seaside shrub ranging from Western Australia to New South Wales. Its vernacular name, Tonga bean wood, is a misnomer; it should be tonka bean wood, as it is due to the strong smell, resembling that of coumarin (a tonka bean product), emitted by the timber. *Wrightia saligna*, a small tree found in Queensland and northern Australia, has a timber resembling that of the English cedar. See ALSTONIA, CARISSA, CERBERA.

Apostle-birds. See GREY JUMPER and CHOUGH, WHITE-WINGED.

Apple, a name popularly applied to several indigenous trees outside the Rosaceae. The broad-leaved, dwarf, narrow-leaved and smooth-barked apples are species of *Angophora* (q.v.). The black apple is a *Sideroxylon*, the crab apple a *Schizomeria*, the emu apple an *Owenia* or a *Petalostigma*, the kangaroo apple a *Solanum*, and the white apple an *Endiandra*.

Apples and Pears. These and other old-world fruits are grown most satisfactorily in the cooler southern districts of Australia or the elevated uplands of more northern areas; but Tasmania and Victoria together grow considerably more than half the whole Australian crop. In Tasmania especially apple-growing has become a most important industry since the improvement in refrigerating machinery in sea-

going vessels has allowed this fruit to be transported overseas without injury. In 1884 100 cases were exported from Hobart, in 1887 4000, in 1914 nearly a million. In 1922-23 about three million cases left Tasmania, half for the mainland, half for oversea countries. Though the acreage under apples in Tasmania is about 30 per cent below that of Victoria, the Tasmanian crop is almost 50 per cent bigger and 45 per cent more valuable.

Although many varieties are cultivated in the Commonwealth, exportable kinds are limited to the few that can stand a long voyage. At present the varieties most in favour for this purpose are:—Cleopatra, Jonathan, London Pippin, Rokewood, Rome Beauty, Stone Pippin, Yates, Granny Smith (New South Wales only), Dunn's Favourite, Rymer, Statesman (Victoria only), Nickajack (Western Australia only), Strawberry Pippin (South Australia only), Crofton, Scarlet Nonpareil, and French Crab (Tasmania only). Apple cultivation is expanding in Victoria, South Australia, and Western Australia; the product is in the main exported to England, though Western Australia still has a market for its fruit on the goldfields. In New South Wales and Queensland the increase does not yet satisfy local requirements. Several good local varieties have been raised, notably Granny Smith, Carrington and Trivett's Seedling. In New South Wales the most suitable districts for apple-growing are found on the tableland and its eastern and western slopes—near Goulburn, Bathurst, Glen Innes, Yass, Tumut and Batlow. In Victoria the suitable area is extensive, the chief districts lying round Portland, Western Port, and Mount Macedon, and in Gippsland. In Tasmania of late years the Huon River district and the north coast show a great increase of cultivated area; in South Australia orchards have spread along the Mount Lofty Range; and recently Western Australia has proved that apples of great excellence can be produced there. As that State is nearer Europe than the others, it will probably develop an extensive export trade. The Katanning and Mount Barker districts are specially notable for their orchards. In 1922-3 (the latest season for which figures are available) the Commonwealth produced 7,199,349 bushels of apples, valued at £1,995,269.

Pears of numerous varieties are grown extensively, but so far only for local consumption; although the fruit has been carried overseas with success, it cannot be depended on to stand a long voyage. Should means be perfected whereby soft fruits can be conveyed to distant countries, a large trade may develop. In 1922-3 the Commonwealth produced 1,315,274 bushels of pears, valued at £356,527. Victoria provided more than half the yield. W.S.C.

Arachnida, a class of animals having four pairs of walking legs, as distinguished from insects, which have three pairs only; this distinction was first made in 1815 by Lamarck. They have also two pairs of anterior limbs—the chelicerae and the pedipalpi—and the head and thorax combine to make a single segment, the cephalo-thorax. The class is divided into eight orders, of which five are represented in Australia—the scorpions (Scorpionida), spiders (Araneida), pseudoscorpions (Pseudo-scorpionida), harvest-men (Opiliones or Phalangida), and mites and ticks (Acarina). All these are discussed in separate articles. W.J.R.

Black Pencil Cedar.

Araliaceae, a family of trees, shrubs or woody climbers (rarely herbs), mostly tropical. The flowers are small, white, greenish or purple in umbels or panicles; fruit usually succulent; leaves simple or compound, often very large and handsome. Members of the endemic genus *Astrotricha* are heavily clothed with a woolly vestiture of star-like hairs. *Panax elegans* (Black Pencil Cedar) is an ornamental tree with large divided leaves, and a soft, light wood that is suitable for lining boards. *P. sambucifolius* (Elderberry Ash) has a sound, tough, prettily-streaked timber.

Araneida. See SPIDERS.

Arbitration. See INDUSTRIAL LAW.

Archer, THOMAS (1823-1905), born at Glasgow in Scotland on 27 February 1823, came to Sydney in December 1837 to engage in pastoral pursuits. In August 1841 he with his brothers John and David took about 5000 sheep from the Castlereagh River across the Darling Downs to the Moreton Bay district, and settled on Stanley Creek, near the Glasshouse Mountains. Hearing of the discovery of Fitzroy Downs by Sir T. Mitchell, Thomas Archer in 1848 found a track to the district from Jimbour on the Darling Downs, along or near which the railway now runs from Dalby to Roma; finding, however, that the distances were too great to attract owners of small flocks, he opened up a track north from the

Brisbane to the Burnett River, took up two runs there, and made a road through to Maryborough for the despatch of his wool to Sydney. In 1849 Archer went to California, and his younger brothers Charles and William took up the task of opening new country. In 1853 they discovered and named the Fitzroy River, and another brother (Colin) sailed a locally-built vessel from Maryborough into the mouth of the Fitzroy, and landed supplies just below a point where a rocky bar obstructs navigation; next year Charles Archer procured the reservation of this site for a township, to be called Rockhampton. Thomas Archer between 1853 and 1878 devoted himself mainly to the development of his properties in Queensland; in the latter year he settled in England, and in 1881 was appointed agent-general for his colony. This post he held in 1881-4 and 1888-90. He died in England on 9 December 1905. (C.M.G., 1884).—The dramatic critic and well-known writer, William Archer, was his son.

Archibald, Jules Francois (1856-1919), born at Warrnambool in Victoria, and trained on the local newspaper, after varied experiences in Melbourne and Queensland (including a brief but sensational career as correspondence clerk in the Victorian education department) became in 1879 a reporter on the staff of the Sydney *Evening News*. Here he met John Haynes, and co-operated with him in founding the Sydney *Bulletin*. For the next twenty years Archibald's life was bound up with that journal; while not specially responsible for its politics, he took complete charge of its literary side, and gathered round him the most brilliant coterie of young writers Australia had as yet seen. Several of them, indeed (e.g. Louis Becke), he may be said to have made; there was not one whom he did not train, and improve in the training. Henry Lawson, Victor Daley, A. B. Paterson, Barcroft Boake, Louis Becke, Steele Rudd, Price Warung, John Farrell—the list could be doubled with ease; and two more names must be added to his list of discoveries, though literature was not exactly their *métier*—those of James Edmond, who succeeded him as editor, and of Norman Lindsay.

After many vicissitudes—including the temporary editorship of W. H. Traill, who brought in Livingston Hopkins and Phil May—the *Bulletin* settled down with Archibald as editor, Edmond as his assistant, and W. Macleod as managing director, to a career unique in Australia (and possibly in the world) which has been thus characterized:—

> At the back of its owners' minds lay the keen desire to stimulate among Australians a love of their own country for its own sake; and from the first they printed, and paid for, every contribution in prose or verse which seemed to be inspirited by such a love, except where the style was too impossibly crude. The result has been the accumulation of a mass of written matter, not often 'literary' in any strict sense of the word, but instinct with the Australian spirit in most of its guises, and including here and there literature more genuine and of higher quality than any previous epoch of Australian letters can show.

This policy—to him it was more than a policy, it was a creed—was Archibald's special gift to Australia as an editor. As a sub-editor (and he was probably the greatest sub-editor Australia has known) he made the policy not only possible but successful by pruning away with delicate and almost unerring judgment the crudities and excrescences that abound in the writings of ardent but untrained youth, and so often stifle a budding genius by making it ridiculous.

In 1902 Archibald's health began to fail, and he withdrew gradually from active work. In 1914 he sold his interests in the *Bulletin* to the still working partners. In 1918, however, tempted by a good offer and the longing to give his critical powers free play again, he joined the staff of *Smith's Weekly*: but his physical strength was unequal to his mental powers, and he died (after a serious operation) on 10 September 1919. His will provided legacies for distressed journalists, hospitals and cancer research, an annual prize for a portrait by an Australian artist, and a sum of money for an open-air memorial 'commemorative of Australia and France having fought side by side for the liberties of the world.'

Archibald's father was an Irishman of Scottish extraction, and his mother a Frenchwoman of partly Jewish descent, so that the qualities of many races blended in him.

Architecture. The earliest buildings of this continent were hastily erected structures of wood roofed with sheets of bark, for timber was plentiful wherever men found it desirable to settle, and wooden buildings were easily and quickly built. Even to this day, in the remoter parts of the continent, the slab hut is the first attempt of the settler to provide shelter. The heat of the climate made shade a necessity, and the verandah soon became customary. Roofs of bark did not prove watertight; they gave place to shingles, which, with gutters around the eaves to catch the rainfall, and barrels or tanks to store it, provided a cleaner and more convenient water-supply than the creek or well. As population increased, saw-pits were provided and sawn timber made available, so that weatherboards superseded slabs, and floorboards took the place of tamped clay. Wooden dwellings show many attempts at design, mostly by way of unnecessary ornament, instead of good form and proportion. The wooden cottage will, for a long time to come, predominate in country districts, and its proper treatment is well worth while. When galvanized corrugated iron was introduced, its cheapness and ease of handling caused it to replace shingles for roofing, and in the hottest regions made it available for walls as well; in nearly all buildings for industrial purposes its use became universal. Much unnecessary ugliness is consequently prevalent.

The great danger of fire soon made more durable materials necessary in the growing towns. Where freestone was available, as in Sydney, it was quickly adopted for the more important dwellings, and Hobart followed suit. They were necessarily plain, and were designed, as was natural, on British examples, so much so that verandahs were not always provided; but, when they were, a simple and dignified pillared treatment was adopted, which, if it had been adhered to generally, would have given a distinctive note to Australian architecture. The constant arrival of new settlers from Britain, and more rapid intercommunication, kept Australia in such close touch with developments 'at home,' that every passing phase of architectural thought was repeated more or less closely—and it must be remembered that the 19th century was essentially one of revivals rather than of logical development. Hence during the first half of the century Italian designs were universal, mostly carried out in cement over brick; as our bricks

were poor in quality, this was an advantage. Government house at Adelaide is a typical example of domestic architecture without verandahs, and Sir Thomas Mitchell's house at Darlinghurst, Sydney, of the pillared shelter type. On one side of the latter there is a perfectly proportioned Greek Doric verandah built entirely of wood, and still in good preservation. Towards the middle of the 19th century, when taste was at a low ebb and cheap ornament popular, commercial firms made a specialty of building accessories such as verandah pillars, railings, and roof crestings, in cast iron of the poorest design, and the simple Italian style of domestic architecture degenerated into an over-ornamented type, of which many examples still exist.

Structures for commercial purposes were at first severely plain, but, as soon as the initial difficulties of settlement were overcome, some attempt at design became apparent. The Italian Renaissance style in its many forms was almost universally adopted, and is still favoured. Fortunately commercial architecture largely escaped the craze for cast-iron ornament which was so prejudicial to our domestic architecture. In some cases a tendency to over-richness in ornament is noticeable; but on the whole reticence, dignity, and good proportions distinguish the more permanent examples, which are mostly occupied by banking, insurance and commercial companies. Several excellent examples are to be seen in Collins-street, Melbourne.

Similar praise cannot be given to most of the buildings used for retail trade. In the early days, before the introduction of plate glass and the great display of goods it encouraged, shop-fronts were divided up into many small panes, and the supports to the superstructure were left visible, the whole effect being fairly harmonious and satisfying. At the present time the insistent demand for the greatest possible area of undivided glass at the street level, and for shelter of the displayed goods by street verandahs, renders a satisfactory solution almost impossible. Add to these the desire of every trader to call attention to his own business, and the universal use of advertising signs, and it will be seen why shop architecture is on the whole vulgar and self-assertive. There are of course exceptions, but not enough to affect the general impression.

The early public buildings of Australia were naturally very simple. Most have disappeared, but there still remain at Port Arthur, in Tasmania, prison, church, and administrative buildings constructed of roughly worked stone. The purpose of the buildings is well expressed and the effect satisfactory, but special architectural character is lacking. Buildings in Hobart, of a later date but worth studying, are the Tasmanian club (built for a bank in 1828), a simple Italian design with a pillared porch; and the custom house (now the parliament house) erected in 1832, and recalling English Renaissance architecture of the 18th century.

In Fowles's *Sydney in 1848* many of the buildings of early date are illustrated; they generally favour Italian or Classic design. The old post office in George-street, with its Doric portico, and the Wesleyan Centenary church in Greek Doric, are both demolished; but the Congregational church in Pitt-street, the supreme court, the houses of parliament, Fort-street school, and the Royal hotel in George-street, all still in existence are typical examples. The four last-named are noteworthy because verandahs and balconies are marked features in their design, thus showing appreciation of climatic conditions. In a different style are the old Scots church in York-street, with its pointed windows, and the government house (the work of Blore, an English architect) in Perpendicular Gothic.

Melbourne was founded in 1837, and its inhabitants were perforce satisfied with the simplest buildings until goldmining, after the first mad rush to the gold diggings, had settled down into a steady industry. Then they commenced building in earnest, and generally favoured simple but dignified designs of Italian character. The national model and training schools, and the old police station and town hall (shown in *Victoria Illustrated*, published in 1857) are good examples. The post office of 1857 was a shed-like building of one storey with verandahs of the common type. Prince's Bridge, when built in 1850, consisted of a single arch of masonry, satisfactory in design, but approached by sloping embankments of earth, very different in appearance from the fine bridge of to-day. Slightly later in date are the Melbourne club, a simple but dignified astylar Italian design of three storeys, and St. Vincent de Paul's orphanage at South Melbourne, an effective composition of central tower, two-storey wings, and connecting open arcades. Perth was settled before Melbourne, but like Adelaide and Brisbane, retains but few examples of public buildings of early date, and these follow the same lines as in the other States.

The years from 1860 onwards saw the development of the towns of Australia into modern cities. Most of the buildings now existing are of this period, which is characterized by great diversity in design and construction; varying from the dignified parliament house, which so finely terminates the vista of Bourke-street, Melbourne, to the essentially modern sky-scrapers which are becoming dominating features in all large cities. As good examples of the public buildings of the period may be mentioned the art gallery, the education department, and part of the treasury in Sydney; the parliament house, the town hall, and the new post office in Spencer-street, Melbourne; the supreme court in Adelaide; and the lands office in Brisbane.

Fortunately public buildings have not so far become too lofty, this defect being confined to commercial structures and residential flats. In Sydney the limit has been fixed at 150 feet in height, and even this is too great for the width of the streets prevailing in that city. Their architectural effect is not altogether satisfactory; however well designed the street fronts may be, the flanks and rear stand out in unrelieved bareness, too often disfigured by huge advertisements. In domestic architecture, on the other hand, the tendency in the suburbs is to reduce the number of stories, dwellings on one floor being preferred mainly because domestic servants cannot be found, and the mistress of the house finds a one-storey house easier to work. In design, also, an improvement commenced in the eighties of last century, and picturesque tile-roofed dwellings, now common throughout the principal cities and towns, began to make their appearance. They are adapted from the type current in Britain and the United States, but have more verandah and balcony space, which in the best examples forms an integral part of the design.

Ecclesiastical architecture in the early days of settlement was necessarily simple, and sometimes adopted Gothic features in a crude form, as in the church at Port Arthur. But St. George's, Hobart, with its fine tower, and St. James's, Sydney, are more characteristic of the early period, when some form of Classic or Renaissance

design was adopted. It was not long, however, before the Gothic revival in England was felt in Australia, and from that time (in the forties or fifties of last century) became almost universal, even spreading to educational buildings, like the universities, and the colleges connected with religious bodies, and to a few commercial structures and large residences. Australia possesses many fine examples of the style, the Anglican cathedrals in Sydney, Melbourne, Brisbane, Adelaide, and Hobart, being especially noteworthy. The Roman Catholic cathedral in Sydney is also excellent, and when completed will probably take pride of place on account of size and site; though the site is rivalled by that of the Anglican cathedral at Brisbane, a prominent rocky ridge above the river. On the other hand the Anglican cathedral at Adelaide is beautifully situated in the park-like valley of the Torrens. Numbers of churches dot the country, some good, others poor in design, but nearly all in the Gothic style. As far as educational buildings are concerned the university of Sydney, especially the great hall, is easily the most distinguished example of Gothic design, though many others show much merit. In such structures the unsuitability of the style to modern requirements, under Australian conditions of climate, are more apparent than in churches, where sentiment plays so large a part in the architectural style adopted.

This raises the question how far the modern architecture of Australia truly corresponds to the conditions of life amongst the people, as modified by climate and the materials available for building. So far no definite departure from British or American examples has been made, except in the greater use of verandahs. In a sunny climate these are a necessary feature, and should form the keynote of any design in which they are introduced, instead of being treated as mere addenda. For instance, if all the business streets of a city were arcaded on a plan resembling that of Bologna in Italy, a striking improvement would be effected, and one step taken towards a distinct and characteristic Australian style.

The adoption of new materials also gives scope for specialization in design; for instance flat instead of sloping roofs are quite permissible where snow is almost unknown; and are most advantageous both in city business buildings as open-air resorts for the employees, and in the suburbs for sleeping out. But so far no distinct treatment has been evolved in which this feature controls the general design, as it must necessarily do if the architecture is to be expressive of the conditions. Another factor which should have a material influence on design is the use of reinforced concrete, instead of building up a structure out of thousands of separate bricks or stones. The standardization of production, so characteristic of modern industry, will also tend to make the repetition of similar parts a feature of the architecture of the future.

J.S.

Argonaut. See MOLLUSCA.

Armstrong, HELEN PORTER. See MELBA, DAME NELLIE.

Arsenic. Arsenic ore is widely distributed in Australia, but has been worked to a limited extent only. In Victoria the deposits are usually of arsenopyrite; a small quantity of arsenic has also been obtained from the flues of roasting furnaces at Ballarat. In New South Wales about 200 tons were obtained in 1910 at Howell in the New England district, and deposits have been also located near Tumut in the south, and Burrowa west of Goulburn. During 1917 the price of arsenic was very high, and supplies were urgently needed in connection with the destruction of prickly pear; consequently the known deposits were more systematically exploited, and search was made for new deposits. The government of Queensland at once reserved from sale a large area of arsenic-bearing country at Jibbinbar near Stanthorpe on the New South Wales border, and private enterprise opened mines about 20 miles away at Beecroft in the border range. The ore of the Stanthorpe district is reckoned 99 per cent pure, and the supply is unlimited. In South Australia arsenic-bearing minerals are worked near Adelaide, at Manna Hill on the way to Broken Hill, and on Kangaroo Island. The Western Australian output is very variable; in three successive years the exports were 1765 tons, 7 tons, and 1075 tons.

Art. The history of art in Australia falls naturally into three periods, of which the first is a mere prologue. Although it includes the work of Watling and Lewin, it was in the main a period of visiting artists, usually attached to one or other of the ships sent to Australia on voyages of exploration. The second period may be said to begin in the early thirties, when the influx of free and moneyed settlers made it possible for an artist to earn his living by making pictures of the rich men's homes and teaching their daughters to paint, elegantly if vaguely, in water-colour. The third period—that of the rise of one or more schools of Australian-born artists—began as recently as the eighties of last century.

On the staff of Joseph Banks in the *Endeavour* were two young artists, Alexander Buchan, landscape and figure painter, and Sydney Parkinson, natural history draughtsman. Buchan unfortunately died at Tahiti on 17 April 1769, and Parkinson confined himself almost entirely to the technical work for which he was engaged, making 280 finished drawings, 675 sketches of plants and animals, and only one drawing of a place or event—the well-known 'Two Natives of New Holland Advancing to Combat.' Phillip's, White's and Hunter's journals contain illustrations of little value, though there is in Hunter's journal an interesting engraving of Sydney Cove reproduced from a water-colour drawing by Lieutenant Bradley. The illustrations to Collins's *Account of the English Colony in New South Wales* were redrawn in England from sketches made, probably, by an artistic convict; there were several in the colony at the time, the two best known being Thomas Watling (q.v.) and John Eyre. Among visiting artists may be mentioned C. A. Lesueur and Nicolas Petit of the Baudin expedition, and William Westall, who accompanied Flinders in the *Investigator* and whose drawings were used to illustrate Flinders's *Voyage to Terra Australis.* The most famous was Augustus Earle, who in the course of much travel spent the years 1825-8 in Australia and New Zealand. and attempted to return in 1831 as artist aboard the *Beagle*, but had to be put ashore in Uruguay on account of ill-health. Harden Melville in 1843 painted landscapes in northern Australia as artist aboard H.M.S. *Fly*: and in 1847-50 a man afterwards more celebrated in other pursuits, Thomas Henry Huxley, was artist as well as surgeon aboard H.M.S. *Rattlesnake.* Another visitor of note was Charles Meryon, the etcher, who in 1842-6,

as an officer in the corvette *Le Rhin*, made a few sketches of scenery and animals on the Australian and New Zealand coasts which he afterwards worked up into etchings.

Precursors of the second period, in that they settled in Sydney and attempted to earn a living by painting and teaching, were J. W. Lewin (q.v.), who resided in Sydney from 1800 to 1819; Robert Read senior, who opened an art school in Pitt-street in November 1814, painted Michael Robinson the 'poet laureate' of the colony in 1821 and Macquarie in 1822, and seems to have abandoned art for agriculture about 1829; and Robert Read junior—apparently unrelated to the other Read—who reached Sydney in 1819 and was still at work in 1849. This Read occasionally spelt his name 'Reid.' But the epoch of resident artists really begins with the arrival in 1831 of John Glover (q.v.), who settled at the age of 64 on a station near Ben Lomond in Tasmania, and went on painting until his death in 1849. One of his pictures is in the National Gallery, London, another in the Melbourne Art Gallery; others are in a municipal gallery at Launceston, Tasmania, and in private collections in that island. The Tasmanian group of early artists includes also Thomas Bock, who worked in Hobart as a portrait painter and engraver from 1825 to 1854 (some of his work is reproduced in Fenton's *History of Tasmania*); Benjamin Duterreau (1767-1851), who migrated to Western Australia in 1832, went on to Hobart, and became the friend both of Governor Arthur and of G. A. Robinson the protector of aborigines; and the notorious poisoner and forger, but excellent artist, Thomas Griffiths Wainewright (q.v.).

Conrad Martens (q.v.) was the second notable artist to settle permanently in Australia. As he was only 34 years old when he reached Sydney, his influence on local art was much greater than that of the veteran Glover. A student under Copley Fielding, he was an accomplished painter with a fine sense of colour and composition, but was inclined to see Australia with English eyes, his treatment of the landscape being usually rather low in tone. Owing to the difficult conditions under which artists worked in the early days, he and others were often forced to become topographical, a painting of some familiar view having a better chance of being sold than a landscape that in itself might be more beautiful and better painted. Martens had a tendency to idealize his subjects; he had also a real sense of beauty, and his best work has an abiding interest. His is the most important contribution to landscape painting in Australia up to the advent of Buvelot in 1865. John Skinner Prout (q.v.) who lived in Australia from 1840 to 1850, was also forced to produce sets of views; but in his best work there is a freshness of treatment and a glow of colour that makes his landscapes (which are usually sunnier than those of Martens) very attractive. Interesting himself in the social life of Sydney, he endeavoured to foster a taste for art there by giving a series of lectures at the Mechanics' Institute. In 1844 he lectured in Hobart, and in 1845 promoted there the first exhibition of pictures held in Australia. He is worthy of his niche, known as 'Prout's Corner,' in the National Gallery at Sydney.

Frederick Garling, who came to Sydney as a child in 1815 and is said to have painted every vessel that arrived in Port Jackson between 1830 and 1870—as he was landing-master, he had enough opportunities—was probably the first Australian marine painter. But the first of any standing was Oswald Brierly (q.v.), a facile wielder of the brush, whose energy and enterprise enabled him to paint a wide variety of subjects during his two visits (1842-50 and 1867-8). As a depicter of the movements of vessels in storm or calm he excelled. His output was remarkable: over 200 of his sketches and paintings are in the Mitchell Library at Sydney. George French Angas (q.v.) is best known as the illustrator of several volumes concerned with the scenery, aborigines, etc., of Australia and New Zealand in the forties, and of the Australian goldfields in 1851: the art gallery at Adelaide has over 180 of his paintings and drawings.

Marshall Claxton reached Sydney in 1850 with a commission from Miss (afterwards Baroness) Burdett-Coutts for a large mural decoration, 'Suffer Little Children to Come Unto Me,' for the infants' class-room in the school attached to the Church of St. Stephen, Rochester Row, Westminster. It was the first large figure composition painted here, and Charles Dickens described it fully when it was subsequently shown in a gallery in Pall Mall (in an article on 'Fine Arts in Australia,' published on 13 March 1852). The first woman painter to attract attention at home and abroad was Adelaide Ironside, born in Sydney on 17 November 1831, whose work won for her the friendship of Daniel Denichy and inspired the eulogies of Francis Adams and Brunton Stephens. Going to Rome in 1856, she devoted herself to painting religious subjects, but died on 15 April 1867, just when her reputation was becoming assured.

In the fifties an interesting group of painters and sculptors settled in Victoria. At the 1857 exhibition of the Victorian Society of Fine Arts in Melbourne works were shown by Nicholas Chevalier (q.v.), the first cartoonist on *Melbourne Punch*, and by Eugene von Guerard, son of the court painter to the Emperor Francis I of Austria. J. A. Gilfillan exhibited 'Captain Cook Taking Possession of New South Wales,' the first of our historic pictures; and William Strutt, the painter of 'Black Thursday,' was represented. The work of two women artists also attracted attention—a set of miniatures being shown by A. M. McCrae, and a medallion by Margaret Thomas, our first woman sculptor. Mrs. McCrae, who arrived in Melbourne in 1841, had been a favourite pupil of John Varley; she was the mother of George Gordon McCrae (q.v.). The various phases of the gold-rush period are preserved for us in the lithographs and water-colours of S. T. Gill (q.v.), a clever craftsman whose intimate glimpses of life in the roaring fifties have an inestimable historic importance.

The sculpture of this period begins with the work of Charles Abrahams, who worked in Sydney in 1843-9; among his works was the first piece of sculpture—a bust—carved from Australian marble (see MITCHELL, SIR T. L.). Abrahams was the forerunner of a much greater sculptor, Thomas Woolner, R.A., who during his visit to Australia in 1852-4 modelled medallions of many prominent citizens of Sydney and Melbourne, and some years later made the statue of Captain Cook that now stands in Hyde Park, Sydney. In Melbourne the most prolific sculptor of the time was Charles Summers, resident there from 1853 to 1866: his most important work was the Burke and Wills group that for many years stood in Collins-street on the brow of its eastern hill, and is now in Nicholson-street. It was the first bronze statue cast in Australia.

During the seventies the sculptor A. Simonetti and the portrait-painter Giulio Anivitti figured prominently. Both were instructors at the New South Wales Academy of Art, and were employed by public bodies and the government on busts and portraits of the notable men of the day. Simonetti's statue of Governor Phillip stands in the Sydney botanic gardens, and Anivitti's portrait of Charles Badham (q.v.) hangs in the Great Hall at the university of Sydney.

The third period of artistic development, though it can hardly be said to begin until the eighties, is closely connected with the work of Abram Louis Buvelot, a Swiss painter who, after spending some years in South America, in 1865 settled in Victoria and began to paint landscapes. Three of his works now in the Melbourne gallery—'Waterpool at Coleraine,' 'Winter Morning at Heidelberg,' and 'Summer Evening near Templestow'—show him as an artist with rare vision, who had the technical skill to convey his spacious impressions on canvas. His influence on the younger Australian painters was considerable; Streeton, Roberts, Patterson, McCubbin, Mather and others, have all acknowledged him as the 'father' of landscape painting in Australia. A court in the Melbourne art gallery is named after him, and his bust by Mackennal is in the collection. The first Australian-born landscape painter was W. C. Piguenit, who was sketching in Tasmania in the fifties. One of his best-known works is 'Mount Kosciusko' in the Sydney gallery.

With the eighties emerges a genuinely Australian group of painters, most of them Victorians. There was still little demand for the work of local men, but in 1885 Tom Roberts, Fred McCubbin and Louis Abrahams established an artists' camp near Box Hill; moving in the summer of 1886 to Mentone on the shores of Port Phillip, they were joined by Arthur Streeton. In 1887 Roberts while on a visit to Sydney met Charles Conder, and in 1888 Roberts, Conder and Streeton established a camp at Eaglemont, which overlooked the valley of the Yarra near Heidelberg. There during 1888-90 they painted impressionist landscapes—Roberts had fallen in love with impressionistic methods during a visit to Europe in 1881-4, and the sketches he brought back set his comrades on the same path. The result was first made public at the historic 'Exhibition of 9 x 5 Impressions' held in Melbourne in August 1889 ('9 x 5' are the dimensions in inches of the lids of a brand of cigar-boxes, on which most of the 'impressions' had been painted). The exhibition greatly pained the art-critics of the day, but the proceeds enabled the artists to pursue their career. In April 1890, however, Conder went to England, and the Eaglemont camp was broken up. Conder diverged into fan-designing, and has affected no artist in Australia except (much later) Thea Proctor. Roberts turned his attention mainly to portrait-painting, though his 'Golden Fleece' (in the Sydney gallery) and his 'Break-away' (in the Adelaide gallery) are fine records of pastoral life. But the influence of Streeton did a great deal towards the founding of an Australian school of landscape painting. He was the first to translate into paint the blue of Australian skies and the clear transparency of Australian distances; when in 1892 he began to work in Sydney, the local artists learnt for the first time (so one of them, Lister Lister, declared) how bright were the colours and how clear the atmosphere of the landscapes they had been accustomed to depict in low tones. Among his immediate comrades and followers in landscape work were David Davies ('A Summer Evening' and 'The Moonrise'), Walter Withers ('Tranquil Winter'), J. Ford Paterson ('The Dawn of Night' and 'A Bush Symphony'), W. Lister Lister ('Banksias'), and Sidney Long ('The Spirit of the Plains').

Another notable artists' camp took the place of Eaglemont. Walter Withers, who had joined the Eaglemont trio after their exhibition, rented Charterisville, a neighbouring house in the Yarra valley, and many young artists at one time or another camped in the grounds, including E. Phillips Fox, Max Meldrum, Will Dyson, John Shirlow, and Lionel and Norman Lindsay.

In Sydney also the last two decades of the century saw an outburst of artistic endeavour, largely inspired by the compilation of the *Picturesque Atlas of Australasia* and the rise of the *Bulletin*. The most important work for these publications was done by imported artists—Phil May and Livingston Hopkins for the *Bulletin*, for the *Atlas* F. B. Schell, W. T. Smedley and W. C. Fitler; but among local artists were employed Julian Ashton, Frank Mahony, A. H. Fullwood, William Macleod and Ellis Rowan; and Charles Conder and B. E. Minns were busy with work for the *Illustrated Sydney News*. All the artists just named made, apart from their black-and-white work, definite and valuable contributions to Australian art, and most of them are dealt with under their names elsewhere in this encyclopaedia, but the work of Julian Ashton was of a special kind; a born leader and a teacher of unqualified sincerity, he both trained and inspired his pupils to follow high artistic ideals, and fought their battle against public and private indifference until the status of the artist in Australia has been placed beyond attack and secured against neglect.

Side by side with Streeton's school of landscape there was growing up, probably instigated, if not inspired, by the commercial demand for illustrative black-and-white work, a school of artists who employed themselves largely in depicting phases of Australian life. Frederick McCubbin—whose best work includes 'On the Wallaby' in the Sydney gallery, 'A Bush Burial' at Geelong, and the noble 'Pioneers' in the Melbourne gallery—was the first to visualize the struggles of the early settlers. The work of Tom Roberts in this category has already been mentioned, and with it must be placed George Lambert's 'Across the Blacksoil Plains,' one of the best-known pictures in the Sydney gallery. Frank Mahony devoted himself mainly to horsemanship and horses; his 'Rounding-up a Straggler,' bought by the Sydney gallery in 1889, and 'The Cry of the Mothers' (1896), are still unique of their kind, and his sketches for the *Atlas* included a number of little masterpieces.

All this activity naturally resulted in the formation and development of art societies. The oldest existing society of this kind is the South Australian Society of Arts, which was founded as far back as 1856. In Sydney an Academy of Art (for which see ART GALLERIES) was founded in 1871, and the Art Society of New South Wales was founded in 1880 by Arthur and George Collingridge; it became 'Royal' in 1907. A Victorian Academy of Art, founded in 1870, was in 1888 reconstituted as the Victorian Artists' Society. In 1895 a number of professional members of the Art Society in Sydney seceded from the main body to become the Society of

Artists: under official pressure this body rejoined the parent society in 1902, but again broke away in 1907. The Australian Art Association was initiated in Melbourne in 1912, and the Australian Painter-Etchers' Society in Sydney in 1920.

In recent years Hans Heysen of South Australia has further developed the rendering of Australian landscape, paying particular attention to the dignity and beauty of eucalypts either singly or in forests: he employs many media, and of late has produced flower paintings of exceptional quality. Among other landscapists J. J. Hilder—the most delicate colourist since Conder—and Blamire Young are in no way derivative; Elioth Gruner's impressions of early morning light, and Max Meldrum's low-toned renderings of bush scenery, call for special mention; and it should be noted that Penleigh Boyd, who was accidentally killed when only 33, was on his way to doing for the wattles what Heysen has done for the eucalypts. In portraiture Lambert and Longstaff, Quinn, Coates, Meldrum, and McInnes, with Hugh Ramsay and E. Phillips Fox, stand out above a large number of followers whose performances are creditable. The only analogue to the post-war 'modernists' of Europe is a small group of which Thea Proctor, John Moore, Margaret Preston and Roland Wakelin are the principal figures. Among marine painters may be classed David Davies, Will Ashton, Charles Bryant, and A. J. W. Burgess.

In 1885 Livingston Hopkins, Julian Ashton, and Henry Fullwood, with a few others, initiated the practice of etching; a few prints had previously been made in Australia, notably by John Mather, but the movement of 1885 was the first sustained attempt to introduce the art. For another twenty years, however, little progress was made. The first of the younger group to adopt this medium was John Shirlow, a Victorian, whose etching 'The Sawmill' prompted Lionel Lindsay to revive the art in Sydney. Lindsay's first prints were shown at the exhibition of the Society of Artists in 1907. Slowly the new movement grew, encouraged by the success of Sydney Ure Smith and Bruce Robertson and the sensational work of Lionel Lindsay's brother Norman—a real but unbalanced genius, who has produced not only a long series of striking etchings and some delicate water-colour drawings, but some of the most remarkable pen-drawings ever exhibited. In 1921 the first exhibition of the Australian Society of Painter-Etchers displayed the work of nineteen members, and the popularity of the art is shown by the fact that the society's sales now considerably exceed those of the Royal Society of Painter-Etchers in London.

Sculpture is an art of comparatively late development in Australia, and until recently lacked local encouragement, so that most sculptors of Australian birth preferred to work in a European milieu. Mention has already been made of several visiting sculptors of the gold-rush period; to them may be added Lucien Henry, a Provençal pupil of Viollet-le-Duc, who fled from Paris in 1871 after an unfortunate connection with the Commune of that year, and became a member of the teaching staff of the Sydney technical college. There he developed the use of the Australian flora and fauna as a base for decorative architectural design, employing the lyre-bird to adorn capitals, the seahorse for bowls, and various foliage-plants for panels. In this direction he has had few followers, if any, but his influence on Australian sculpture was definite and good. The most notable Australian sculptor of the present day is Sir Bertram Mackennal (q.v.). Harold Parker's best work is the beautiful 'Ariadne' which was bought by the Tate Gallery. Web Gilbert (q.v.), with a long array of portrait busts and imaginative works to his credit, is the official sculptor to the Australian War Museum. Nelson Illingworth has also specialized in portrait busts. George Lambert, the most versatile of Australian artists, has essayed sculpture at times with considerable success, especially in a war memorial for Geelong and a design for the war memorial at Port Said. Probably the most typical Australian work is that of Douglas Richardson, including 'Pioneer,' 'The Mirage,' and 'The Discovery of Gold.' A small group of women sculptors includes Dora Ohlfsen, Theo Cowan, Margaret Baskerville and Eva Benson.

In 1924 a school of sculpture was opened at the technical college in Sydney under the superintendence of G. Rayner Hoff, a former winner of the Prix de Rome.

The first Australian artist to receive a European award was Rupert Bunny, who in 1890 gained a *Mention Honorable* at the Paris Salon; Longstaff was similarly honoured in 1891, and Streeton in 1892. The first medallist at this Salon was E. Phillips Fox. Of the New Salon Phillips Fox, Rupert Bunny and Bessie Davidson were elected sociètaires and George Lambert and George Coates associates. Mackennal is a R.A., Lambert an A.R.A.: Mackennal, Parker and Gilbert are all represented in the Tate gallery, and Rupert Bunny and Charles Conder in the Luxembourg. In 1915, it may be noted, the exhibition at the Royal Academy included pictures from every State in Australia: 24 artists in all were represented, of whom six had pictures hung 'on the line.' A small exhibition of Australian pictures was held in London in 1898, and a more important one in 1923.

See ART GALLERIES, under which heading the most important pictures in each gallery are enumerated. The best aid to a study of Australian art is the series of monographs and articles embedded in *Art in Australia*, and the separate volumes (issued by various publishers) on Conrad Martens, J. J. Hilder, Arthur Streeton, Blamire Young, Hans Heysen, George Lambert, F. McCubbin, and Penleigh Boyd. W.M.

Artesian Water. Australia is notable for the great extent of its artesian-water-bearing areas, which occupy (roughly) 950,000 square miles out of a total of 3,000,000. As at present defined, there are six basins more or less developed, and a small undeveloped basin east of Wyndham on Cambridge Gulf. The six are:—

		AREA sq.miles
1.	The Great Artesian Basin	602,000
2.	The Murray River Artesian Basin	107,200
3.	The Eucla Artesian Basin	74,300
4.	The Coastal Basin of Western Australia	10,500
5.	The North-west Basin of Western Australia	40,500
6.	The Desert Basin of Western Australia	115,000

Of these the first-named is by far the most important and most interesting.

1. The Great Artesian Basin extends from the Gulf of Carpentaria in northern Queensland southwards into New South Wales and South Australia—as far south, in fact, as 32° S. lat. Recent investigations by Sir Edgeworth David go to show that the northern part of this basin

(from Cloncurry northwards) is a separate basin draining to the Gulf, whereas the main basin drains towards Lake Eyre.

The principal water-bearing strata are of Trias-Jura age, and consist of porous sandstones of freshwater origin, resting uncomformably upon a series of highly-folded lower Palaeozoic strata, which form the necessary underlying impervious layer. Overlying the water-bearing strata is a series of more or less horizontal layers of marine shales, sandstones and impure limestones of Cretaceous age; these, taken as a whole, form the upper impervious layer necessary to give artesian conditions. The intake-beds for this basin have, at altitudes of as much as 2000 feet, but over the greater part of the basin the surface of the country is only a few hundred feet above sea-level. The floor of the basin is very uneven; a partly buried ridge, which extends from near Charleville in Queensland to Bourke in New South Wales, divides the southern part of the basin into two very unequal parts—an eastern portion with a maximum depth of 3000 feet, and a western portion with a depth of 4500 feet at Bimerah in New South Wales, and perhaps as much as 5000 feet in South Australia. In northern Queensland there is a broad upward bulge extending from Cloncurry eastwards to Saxby

along its eastern and south-eastern margins, a thickness of about 2500 feet, and outcrop along the western side of the main tableland belt up to altitudes of 2000 feet. Followed westwards, they dip rapidly below the western plain to 3000 and 4000 feet (or even more) below sea-level. Along the southern and western margin of the basin these outcrops are hidden, for the most part, by more recent deposits. That the main water-bearing beds over this basin are Trias-Jura age is shown by the fossil plants (such as *Taeniopteris diantrcei* and *Thinnfeldia odontopteroides*) obtained from the bore-cores. The artesian water which occurs in porous layers in the overlying Cretaceous formations is relatively unimportant in quantity.

Water-bearing strata are known to outcrop Downs, over which the floor of the basin is in places less than 500 feet deep, the depth to the northern side increasing rapidly to 3500 feet, and on the southern side increasing less rapidly to 2500 feet below sea-level. As stated above, it is probable that this bulge actually separates two basins.

The temperature of the bore water varies very much in different localities, but in all cases is much higher than one would expect for water derived from undisturbed sedimentary strata. The water from Elderslie No. 2 bore in Queensland (depth 4523 feet) reaches the surface with a temperature of 210° F.; Goyder's Lagoon bore in South Australia (depth 4550 feet) has a temperature of 208° F. Over large areas the temperature-gradient ranges from 1° F. in 30 feet,

to 1° F. in 22 feet, and in some cases even steeper gradients have been found. There are, however, wells with a more normal gradient, e.g. a well near Walgett in New South Wales with a gradient of 1° F. in 70 feet; but such low gradients are uncommon. The increase of temperature with depth is also not by any means regular in individual wells. For example, in the Mirra Mitta bore in South Australia the temperature of the water increased from 122° F. at 3485 feet to 176° F. at 3506 feet, while at 3534 feet it rose to 190° F. In bores that have been re-examined after flowing for some time the temperature has sometimes decreased, sometimes increased—in one case by as much as 10 degrees in two years.

Water from all bores in the Great Artesian Basin is strongly alkaline. Analyses of the salts from four widely-separated bores in New South Wales are as follows:—

Sodium Carbonate	32.63	40.00	38.34	17.37
Potassium Carbonate	1.70	—	trace	6.61
Calcium Carbonate	0.50	1.12	1.21	1.55
Magnesium Carbonate	0.12	trace	0.26	1.93
Sodium Chloride	7.25	6.91	7.23	9.55
Sodium Sulphate	—	—	0.86	—
Silica	1.76	—	1.96	1.43
Total solids in grains per gallon	43.96	48.03	48.86	39.99
Total solids in 1000 parts	0.63	0.68	0.69	0.57

The water is, therefore, of the alkaline carbonate type, the most abundant constituent being sodium carbonate, which accounts for nearly 80 per cent of the total solids. Comparing these analyses with those of artesian waters from other basins, we may note the general absence of sulphates, the relatively small percentage of sodium chloride, and the small percentage of potassium and calcium carbonates. The mineral content, however, is well below that which would render it unfit for consumption by stock, for which purpose it is very largely used, thus making available for pastoral purposes large areas that would otherwise be practically useless in most seasons. In some places the water has been used for irrigation purposes; but this, if continued, charges the soil with alkali, so that its irrigational value is not great. The bore water brings to the surface not only solids in solution but also considerable quantities of gases, including nitrogen, carbon dioxide, methane, and (occasionally) a little oxygen; the methane is probably derived from the coal-seams known to occur in the artesian series. Nitrogen is the most abundant of the gases given off; as to the source of this gas there is considerable difference of opinion.

The total daily flow from the wells in this basin is probably not less than 700 million gallons. The largest flow obtained from any one well was 2,333,000 gallons per day (from the Yarmouth bore in Queensland); many wells when first sunk gave flows of over 1,000,000 gallons per day. Unfortunately after a time the flow, in all cases, begins to decrease; careful observation in New South Wales places this decrease in some cases at six to seven per cent per annum. Consequently in recent years attention has been directed especially to the probable origin of the water. Until a few years ago it was generally believed that the supply was derived directly from rainfall on the intake-beds, and that water removed from the bores would be rapidly replaced by rain-water—in other words, that the water has a 'meteoric' origin, being derived from the atmosphere. The evidence in support of this theory was as follows:—

(*a*) The area within which the wells occur is a true artesian basin, and nearly everywhere within it the water is under sufficient pressure to rise to the surface when a bore-hole is put down.

(*b*) The intake-beds outcrop over a sufficiently large area, and are sufficiently porous, to gather the necessary supply of water from rainfall.

(*c*) The intake-beds outcrop at a sufficient altitude (on the eastern side of the basin) to give the necessary hydraulic grade.

This theory was first challenged in 1906 by Professor J. W. Gregory, who maintained that many of the observed facts were opposed to this explanation, and argued that the greater part of the water in this artesian basin was of 'plutonic' origin—i.e. that it had been derived from the interior of the earth, and not from the rainfall. The importance of this view lay in the implication that, instead of the supply of water being constantly replenished by rain-water, there was probably a definite limit to the amount of water actually available.

Some of the factors difficult to explain under the meteoric hypothesis, but capable of explanation under the plutonic hypothesis, are:—

(*a*) The unusually high temperature-gradient found in most of the wells.

(*b*) The very irregular increase of temperature with depth in some of the wells.

(*c*) The peculiar salinity of the water, and the variation of salinity which occurs in different parts of the basin; also the occasional presence of boric acid.

(*d*) The nature and amount of dissolved gases.

(*e*) Anomalies in the arrangement of the isopotential lines, which in some places suggest that the water is flowing in a direction incompatible with the meteoric theory.

Even if the origin of the water is meteoric, it is still doubtful whether percolation from the intake-beds is rapid enough to maintain the supply against the demands now being made upon it. A. L. Du Toit of South Africa has recently arrived at the conclusion that none of the present rainfall over the intake-beds will become available within the basin, even along its margin, until after the lapse of centuries, and that, though most of the water at present stored in the basin is of meteoric origin, it was stored there during previous geological periods.

2. The Murray River Basin is situated in southern Australia along the lower course of the Murray River. It has an area of 107,200 square miles, divided between Victoria, New South Wales and South Australia. Over most of this area the water is sub-artesian—that is, not under sufficient pressure to make it rise to the surface. It is met with at a depth of 80 feet to 100 feet, and is pumped to the surface by windmills. Sometimes it is slightly brackish. The strata in this region are of lower Tertiary age (lower Miocene) and consist of horizontal layers of sandstones, shales, and limestones. Recently true artesian water has been obtained in this basin from bores put down on Belmore and Lake Victoria stations in the New South Wales section. The water (which is slightly saline, but is suitable for stock) was struck at depths of from 600 to 700 feet; it rises a few feet above the surface, and the flow varies from 50,000 to 100,000 gallons a day.

3. The Eucla or Nullarbor Basin lies along the shores of the Great Australian Bight, extending 400 miles east from Israelite Bay and about 200 miles inland. Its area is about 74,300 square miles, mainly Tertiary limestones

resting upon what are probably Cretaceous marine beds. The water is for the most part sub-artesian, a saline quality being struck at 900 feet and a much fresher quality below that depth. In some cases (e.g. the Madura bore, 2000 feet deep) the water rises to the surface. It has been found that horses thrive on water containing 1 oz. of salts to the gallon, while cattle can stand 1½ oz. and sheep 2 oz.—even 3 in a dry season.

The South Australian government is having bores put down in an area between the Eucla and the Great Australian basins bounded by the transcontinental (east-west) railway, the 132nd meridian and the boundary of the Northern Territory The first bore lies west of McDouall Peak.

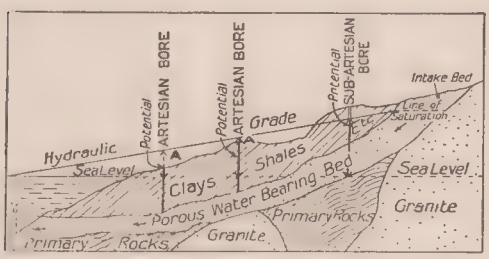
4. The Coastal Basin of Western Australia is a long, narrow artesian basin parallel and adjacent to the southern part of the western coast of Western Australia, and extending from Geraldton almost to the southern coast. It yields a fairly abundant supply of artesian water. Geologically it consists of recent dune rock resting upon gentle dipping cretaceous marine strata, which in turn rest upon Permo-Carboniferous strata. Interdependence between the rainfall and the outflow of artesian water in this basin appears to have been definitely proved.

5. The North-west Basin of Western Australia extends from Gantheaume Bay to Onslow. About 69 bores have been put down, and from one of them a flow of nearly 3,000,000 gallons per day was obtained, though the bore is only 300 feet deep.

6. The Desert Basin of Western Australia, which extends from a little east of the De Grey River to beyond Derby, and for a long distance inland, is hardly developed at all, and its boundaries are still uncertain. The area assigned to it at the beginning of this article is therefore a mere approximation. C.A.S.

Economic Uses.—Over a large proportion of Australia the average rainfall is less than 15 inches per annum, and any adequate system of water conservation from surface supplies is impracticable. In the settlement of such regions artesian water, where available, plays a most important part, and bore-drains, fed with a constant stream from the bore-head and reticulated through large areas of pastoral property, have during droughts saved very large numbers of stock.

Problems connected with this artesian water were discussed by inter-State conferences of geologists and engineers in 1912, 1914, 1921, and 1924. The accompanying diagram, taken from the



Generalized Section of an Artesian Basin, with an outlet to the ocean.
A—Height corresponding to observed pressure.

report of the 1914 conference, shows the conditions existing in a typical artesian basin with an outlet to the ocean.

Boring Plant.—Artesian water was first discovered in 1879 at Kallara station in the north-west of New South Wales. In sinking some of the earlier bores diamond-drill and calyx plants were used, but the types usually adopted were the Canadian pole rig and the cable rig with Manilla rope. Modern plants are of the cable type, with wire rope and side cutting-tools; this avoids the under-reaming required with the earlier type of straight bit, and the cost of boring is thus much reduced. The most modern plants are fitted with hydraulic rotary attachments, in place of percussion tools, for working in shale or soft strata. The bore-hole is lined with steel swelled-joint casing, in several strings. In properly cased bores the first string, usually 10 to 12 inches in diameter, is sunk to a depth of several hundred feet below the surface; inside it is sunk the second string, of 8 inches' diameter; this is carried down to a hard stratum, and firmly seated by driving it into a smaller hole cut with a straight bit. In some recent bores it is cemented in. The inner string, usually 6 to 6½ inches in diameter, is then taken to the bottom of the bore, and perforated opposite to the water-bearing strata; where there is no danger that the strata will cave in, the casing may be partly withdrawn and suspended above them. In bores where, on account of the great depth or other reasons, difficulty is experienced in drilling, there may be a fourth string of casing, 5 inches in diameter. The strings of casing are closed at ground-surface by a head-piece, fitted with a valve for controlling the flow. Discharge is made into an excavated basin, from which lead the bore-drains, suitable divisors being provided for distributing the flow as required. The drains are small channels, constructed with a delver, and in the case of many bores have an aggregate length of from 40 to 80 miles.

Diminution in Flow.—In order to prevent waste of water it is most desirable, where the bores are properly cased, that the flow be shut off, or partially so, when not required; unfortunately the defective casing of most of the earlier bores does not admit of this. The importance of preventing waste is emphasized by the general diminution in the artesian flow. For example, in two districts of New South Wales (each approximately 11,000 square miles in area) where regular observations are taken, it has been found that the recent decrease in flow is in one case about 2.4 per cent, in the other about 6.5 per cent, per annum. In the second district the decrease is partly due to corrosion of the casing in some of the bores; but the main reason, doubtless, is the drain on the basin due to the multiplication of bores, which are here much closer together. Of 977 flowing bores in Queensland 124 had been remeasured up to 1914; these in 15 years showed a decrease of 40 per cent in their aggregate flow.

The conference mentioned above recorded its opinion that the primary cause of the diminution in flow in Queensland and New South Wales is the overdraft which has already been made upon the accumulated supply of the Great Basin by the undue multiplication of bores, and urged (*a*) that future bores should be sunk only at sites where the surface-level will admit of the supply being used without waste, and (*b*) that they be properly constructed and cased, so as to admit of closing them when the supply is not required.

Corrosion of the casing has given trouble in the Coonamble district in New South Wales, and also in parts of Queensland. The cause

of the corrosion is being investigated, but no conclusion has yet been arrived at. In a bore sunk some years ago at Coonamble the casing was lined with oregon staves one inch thick as a protection against corrosion; in a more recent case in the same locality a cement lining two inches thick was forced in by pumping from the bottom between two strings of casing.

Utilization.—Artesian water is used to a small extent for town supplies, and for the production of power (by means of Pelton wheels and other hydraulic prime movers) for operating sheep-shearing, lighting and other plants; but its principal use is for pastoral purposes. When running streams are not available on a station, supplies of water are usually obtained by sinking tanks and wells; this makes it necessary for stock to travel long distances to water, trampling and destroying on their way large quantities of feed. On the other hand, in country watered by artesian bores the water is carried to the stock in a running stream for miles through the paddocks, and the carrying capacity is correspondingly increased.

At Moree in New South Wales, on the south-eastern edge of the Great Basin, a bore 2800 feet deep provides 600,000 gallons per day, which supply thermal baths for those suffering from muscular or nervous diseases. The surface temperature of the water is 109° F. and that of the main bathing pool 100°.

Statistics for 1923.—

State	Flowing bores public	Flowing bores private	Daily flow in million gallons	Maximum depth in feet	Maximum temperature
New South Wales	133	251	83	4338	139°F.
Queensland.....	86	1201	399	7009	210°F.
South Australia..	42	no record	16	4850	208°F.
Western Australia	108	90	58	3400	140°F.

Practically all Victorian bores are sub-artesian. Tasmania has none. In the Northern Territory one bore is artesian. In these statistics, which are the latest available, sub-artesian and pumped supplies are not included.

H.H.D.

Art Galleries. The first public art gallery in Australia was opened by Sir Henry Barkly on 24 May 1861 on the ground floor of the north wing of the Melbourne public library: its contents consisted almost entirely of casts of statues and *bassi relievi*. In October 1863 a commission appointed by the legislature to consider the promotion of the fine arts in Victoria recommended the formation of a public gallery and school of art, and on 24 December 1864 a picture gallery was opened on the first floor of the north wing, and £2000 was voted by parliament for the purchase of pictures in England, besides £200 for a picture by a local artist: the picture selected was Chevalier's 'The Buffalo Ranges.' In 1866 an intercolonial exhibition was held in the library grounds, and the pictures were re-hung in a temporary gallery on the site of the present Verdon gallery. In 1869 an exhibition of works of art, etc., produced a balance of £450 which became the nucleus of the travelling scholarship fund, and on 29 December (in accordance with the final report of the commission mentioned above) the public library, museums, and national gallery of Victoria were by act of parliament incorporated under 15 trustees (see LIBRARIES, PUBLIC). In 1873 the building of a new picture gallery (now the Macarthur gallery) was begun, and on 24 May 1875 the gallery was opened to the public. Meanwhile in 1870 Eugene von Guerard had been appointed head of a school of painting (with six students) and Thomas Clarke head of a school of design, with 35. These schools rapidly achieved popularity, and in five years the number of their students had increased to 41 and 152. Von Guerard was succeeded in 1882 by G. F. Folingsby, who was made 'Director of the National Gallery,' and he in 1891 by F. McCubbin (temporarily). In 1892 Bernard Hall took over the directorship. The first travelling scholarship was awarded in 1887 to John Longstaff. Among the important pictures, etc., acquired by the gallery in these early years are Lady Butler's 'Quatre Bras' (1884), Orchardson's 'First Cloud' (1887), Boehm's bronze group 'St. George and the Dragon' (1888), Turner's 'Dunstanborough Castle' (1888), Alma Tadema's 'Vintage Festival' (1888), Waterhouse's 'Ulysses and the Sirens' (1891), Streeton's 'Purple Noon's Transparent Light' (1896), and Phillips Fox's 'Landing of Captain Cook' (1902). Among the scholarship-holders since Longstaff are George Coates (1896), D. M. Meldrum (1899), Isaac Cohen (1905), and Constance L. Jenkins (1907).

Since 1904 the history of the Victorian gallery is bound up with that of the Felton bequests. In 1904 Alfred Felton (q.v.) left half his residuary estate, amounting to about £190,000, for the purchase of works of art ancient or modern, or antiquities, or other works that might be selected by a specially appointed committee and approved by the trustees of the Victorian gallery. All such purchases must be presented to the gallery and marked with the words 'Felton Bequest.' The original committee consisted of Dr. Charles Bage, F. S. Grimwade, Edward Langton, F. R. Godfrey and J. A. Levey; Professor E. E. Morris, whom Felton had nominated as the first trustee, predeceased the testator. The present trustees (1925) are Dr. Bage, J. A. Levey, E. N. Grimwade, Sir J. H. Macfarland and Dr. Alexander Leeper. The trust estate is now worth nearly £600,000, and the income available for 1923 amounted to about £22,000. No preference is given to Australian works of art, the committee considering that it has no power to allocate funds to any special department. Australian pictures, etc., are acquired by the committee and the gallery trustees acting conjointly, usually on the advice of the director of the Victorian gallery. Outside Australia selection is for the most part left to expert advisers. Of these F. W. Gibson was appointed on 23 December 1908 and retired on 31 December 1915, having had the help of Sir Sidney Colvin in 1913-5. After an interregnum caused by the war, Robert Ross was appointed adviser in November 1917, but died on 5 October 1918, and was succeeded by the present adviser, Frank Rinder. The committee has also been assisted at various times by George Clausen, R.A., Joseph Pennell, M. de Vasselot, L. Bénédite, Charles Ricketts, Percy Macquoid and D. S. MacColl.

Among the works of exceptional importance acquired by the gallery through the bequest committee are, Pissarro's 'Boulevard Montmartre,' Clausen's 'Ploughman's Breakfast,' Ford Madox Brown's 'Entombment,' and Auguste Rodin's 'Head of Jean Paul Laurens,' all bought in 1905; Corot's 'Bent Tree' (1907); Mackennal's 'Circe' (1909); J. M. W. Turner's 'Walton Bridges' (1919); Van Eyck's 'Madonna and

'Child'—the Ince-Blundell Madonna—and Van Dyck's 'Countess of Southampton' (both in 1922); Orpen's 'Chinese Shawl' (1923); self-portraits of Hugh Ramsay (1906) and George W. Lambert (1921); Raeburn's 'James Wardrop' (1925); and a series of drawings for Dante's *Divina Commedia* by William Blake (1918). There is a representative collection of Norman Lindsay's pen-drawings, and a model of Cook's ship the *Endeavour* by the same artist; two Books of Hours, the Wharncliffe and the Cobham; and a valuable collection of Chinese ceramic ware and bronzes.

New South Wales.—At a meeting held in Sydney on 25 April 1871 under the chairmanship of Thomas Sutcliffe Mort (q.v.) the New South Wales Academy of Art was formally constituted with Mort as president and E. L. Montefiore as vice-president. Premises were leased in Elizabeth-street, and classes held there under Signori Anivitti and Simonetti. In 1875 the government established and subsidized a Gallery of Art, choosing its trustees from the council of the Academy —Sir Alfred Stephen, E. L. Montefiore, Eccleston Du Faur, J. R. Fairfax and J. H. Thomas. The first purchases made for this gallery—six water-colour drawings—are now grouped together in the Sydney gallery. In the Sydney international exhibition of 1879-80 a building at the entrance to the botanic gardens was set aside for a fine arts show; when in 1880 this building was vacated, the government handed it over temporarily to the gallery trustees and voted £5000 for the purchase of pictures—a vote which was repeated annually until 1893. But the temporary gallery was insecure and inconvenient, so that almost immediately the erection of a permanent gallery was begun, and on 23 December 1885 the nucleus of the existing gallery was opened by Lord Carrington. The first of the existing courts was opened on 24 May 1897 by Lord Hampden, the whole of the southern wing and basement by B. B. O'Conor (then minister for education) on 31 October 1904, and the central façade and entrance in 1906. In 1885 the value of the collection was about £14,000: in 1924 it was estimated at £168,000, and included 526 oil-paintings, 418 water-colours, 815 specimens of black-and-white work and 177 pieces of sculpture.

Among the more notable pictures in the gallery are Millais' 'Captive' (purchased in 1885), Ford Madox Brown's 'Chaucer' (1876), De Neuville's 'Rorke's Drift' (1882), Luminais' 'Sons of Clovis' (1886), Greiffenhagen's 'Judgment of Paris' (1897), Brangwyn's 'The Scoffers' (1898), Lavery's 'The White Feathers' (1900), and Hoffbauer's 'Sur Les Toits' (1905). Mackennal's 'The Dancer' and Frampton's 'Peter Pan' are prominent in the sculpture section. Australian art is well represented with Ashton's 'Sir Henry Parkes' (1890), Streeton's 'Still Glides the Stream' (1890), Tom Roberts's 'Golden Fleece' (1894), Longstaff's 'Lady in Black' (1896) and portrait of Henry Lawson (1900), Lambert's 'Across the Blacksoil Plains' (1899), Phillips Fox's 'Motherhood' (1913), Gruner's 'Morning Light' (1916), Hugh Ramsay's 'Sisters' (1921), and Heysen's 'Flowers and Fruit' (1921). The gallery depends entirely on the State for funds —a severe handicap in times of public retrenchment—but is able from bequests to award two prizes annually. The Wynne Art prize is given for the best painting of Australian landscape or the best piece of figure sculpture; the Archibald prize goes to the best portrait (preferably of a distinguished Australian) painted by an Australian artist resident in Australia.

South Australia.—In 1880 the government of South Australia bought £2000 worth of pictures, and in 1881 a public art gallery was opened in two rooms of the public library building by Prince Albert Victor of Wales. In 1889 the gallery was transferred to the jubilee exhibition building, and in 1900 was housed in a building of its own, erected by the government with a bequest of £25,000 from Sir Thomas Elder (q.v.). Among later bequests was one of £16,500 in 1903 from Dr. Morgan Thomas; and in 1907 David Murray left the gallery £3000 in cash and a valuable collection of engravings and woodcuts. Other collections illustrate ceramics, archaeology, and Australian history and exploration, and a collection of coins (the largest in Australia) was commenced early in the history of the South Australian Institute. Among the more notable pictures in the gallery are G. F. Watts's 'Tennyson' and 'Love and Death,' Orpen's 'Marshal Foch,' Bouguereau's 'Virgin and Child,' Tom Roberts's 'Breakaway,' Waterhouse's 'Circe Invidiosa,' two flower-pieces by Fantin La Tour, and several examples of Hans Heysen. Sculpture is represented by Swan's 'Puma with a Macaw.'

Queensland.—The art gallery of Queensland began as a collection of pictures and engravings belonging to the government, several 'old masters' bequeathed by T. de M. Murray Prior, and pictures lent by prominent citizens, hung in the Brisbane town hall and opened to the public by Sir Henry Norman (then governor) on 29 March 1895. It was at first controlled by a board of trustees spasmodically financed by the government—a three years' grant of £500 was followed by a three years' grant of £1000, and that by a three years' grant of £250 and one year's of £100. In 1905 the whole collection was taken over by the government and placed in the executive building, where an art gallery was formally opened by Lord Chelmsford on 18 December 1905. The wall-space has for many years been inadequate, and many pictures are stored; Cadogan Cowper's 'Grave Scene from *Hamlet*,' Arnesby Brown's 'The Drove,' and Charles Sims's 'Morning News' are prominent among those shown, and the sculptured head 'Esther' by Harold Parker is also noticeable.

Western Australia.—In 1895 the Perth Museum was enlarged, and the opportunity was taken to display a small collection of pictures. In 1901 the Duke of York (now King George V) laid the foundation-stone of an art gallery, but the building was not proceeded with until 1906, and the gallery was opened by the governor of the State on 25 June 1908. The pictures, though comparatively few, are carefully selected, and include works by Gainsborough, Lawrence, Clausen, and Daubigny, and the Australians Heysen, McCubbin, and Phillips Fox.

Tasmania.—The Hobart art gallery is housed in a room in the Tasmanian Museum, and is managed as part of the museum. Poynter's 'Chloe' and several works by the Tasmanian artist Piguenit are its principal possessions. In another room is shown a collection of paintings illustrating Tasmanian history and ethnology. The Royal Society of Tasmania also owns a collection of historical paintings and drawings, which include a series of pencil drawings by Conrad Martens.

In several States there are small country galleries. Ballarat, Bendigo and Castlemaine in Victoria, Tamworth in New South Wales, and Launceston in Tasmania have the best-known. Each has a small collection of pictures as a permanent nucleus, but depends for its maintained

interest on pictures lent by the central State galleries.

Arthur, Sir George (1784-1854), born at Plymouth on 21 June 1784, joined in 1804 the 91st (Argyllshire) Highlanders (ensign, 1804; lieutenant, 1805; captain, 1808; major, 1812; colonel on the staff, 1814; colonel, 1837; major-general on the staff, 1837; major-general, 1846; lieutenant-general, 1854). He served in Sir James Craig's expedition to Italy in 1806, was afterwards adjutant of the light battalion on service in Egypt, and was engaged in the attack on Rosetta; in 1808 he served under Sir James Kempt in Sicily, and in the following year commanded the light company of his regiment in the expedition to Walcheren, where he took part in the attack on Flushing. For his services he was thanked in general orders, was appointed deputy-assistant-adjutant-general on the field, received the freedom of the city of London and a sword, and was similarly honoured by his native town. He afterwards served as military secretary to Sir George Don, governor of Jersey, and in 1812 was made assistant-quartermaster-general in Jamaica. From 1814 to 1822 he was lieutenant-governor of British Honduras, where he studied problems arising out of slavery and the proposed emancipation measures. Returning to England on leave in 1822 to give the British government the benefit of his advice, he was chosen to inaugurate reforms in the system of transportation to Australia, and in 1823 appointed lieutenant-governor of Tasmania, with powers that practically made him independent of his nominal superior at Sydney (see *H.R.A.* I. xi. 109). 'His strong good sense and humanity' writes Sir. A. Arbuthnot in the *Dictionary of National Biography,* 'indicated the possibility of a middle course between the extreme severity of the system which would make transportation simply deterrent, and the over-indulgence of the system which aimed at reforming the convict by gentle treatment. He held that it was possible to make transportation a punishment much dreaded by criminals, whilst offering every facility for reform to those who were not hardened in crime, but he entertained no quixotic expectations of frequent reformation.' He reached Hobart on 12 May 1824. Just before his arrival John Lewes Pedder (q.v.) had been appointed chief justice of the island, and had on 7 May proclaimed a new charter of justice; and the act that created a supreme court also provided for the separation of Tasmania from New South Wales. Accordingly Colonel Darling, on his way from England to assume the government of New South Wales, visited Hobart and on 3 December 1825 formally proclaimed Tasmania a separate colony. Arthur was compelled to bring into existence executive and legislative councils; but he refused to be hampered by them. Strong in the knowledge of his high aims and greater experience, he altered or annulled laws which stood in his way, suspended officials who would not work harmoniously with him, and fought the British government itself when it sent out orders that he thought ill-advised. Despotic as his rule was—possibly just because it was despotic, and his—the colony grew and prospered. During his 12 years the population trebled, the revenue increased sixfold, and trade grew from £75,000 a year to £900,000. Education and religion prospered equally; the bush-ranging evil was mastered and almost exterminated; the convict population was classified, and its most dangerous elements segregated on Tasman's Peninsula, whence escape was almost impossible; the few aborigines, who had been driven into an attitude of bitter hostility to the whites, were gradually collected and similarly segregated on the islands north-east of Tasmania. But in carrying out these reforms—for reforms they were, if not exactly the reforms that the humanitarian spirit of the time demanded—Arthur's masterfulness brought him repeatedly into conflict with the local and the Sydney press, which was struggling for freedom. He had, it is true, the unswerving support of the best of the Tasmanian pressmen, James Ross; but the criticism (often deliberately malign) of less worthy opponents has lived longer than Ross's eulogies; and in this as in other respects Arthur, with noble aims and exceptional ability, was fighting the spirit of the age.

Four events of his lieutenant-governorship are specially notable, and are narrated in detail elsewhere: the creation of the Port Arthur convict settlement (see Convicts), the creation of the Van Diemen's Land Company (q.v.), the Black War (see Tasmania), and the expeditions of Batman and Fawkner, which resulted in the foundation of the Port Phillip settlement (see Victoria). After 12 years of rule he returned to England in March 1837, and received the Hanoverian Order. At the end of the same year he was sent as lieutenant-governor to Upper Canada. Here he ruled during a dangerous period: an abortive rebellion was barely over when he arrived, and one of his first tasks was to meet and crush invading bands from the United States. When in 1841 the two Canadian provinces were united under a single governor, Arthur received a baronetcy for his services, and in 1842 became governor of Bombay. His work in India was even more arduous than that previously demanded of him, and was excellently done. Throughout the Afghan and Scinde wars, the cross-currents of Lord Ellenborough's viceroyship, and the ever-recurring quarrels of Outram and Napier, Arthur kept a clear head and a steady course, winning and retaining the respect of all those otherwise discordant personalities as well as of the Company's directors. Moreover, in his own province he initiated reforms in irrigation, land-taxation and sanitation, besides pioneering the construction of railways and the reclamation of the Bombay foreshores. Returning to England in 1846, he was made a privy councillor. He died in London on 19 September 1854.

Arthur's abilities and character cannot be gauged solely on his Tasmanian achievements. Like Macquarie and Gipps—both great men, who made bitter enemies and suffered for it—he was set to administer an Australian colony at a time of transition, and earned deep unpopularity by enforcing his policy (which he had been specially chosen to enforce) against the wishes and interests of influential local residents. Tasmania for him, as for the British government of his day, was intended for the safe imprisonment and eventual reform of convicts, not for the settlement of free men, and it is obvious that in a prison or a reformatory the free man and his free institutions are intruders. Further, he found the colony infested with bushrangers, whose cruelties had turned the aboriginal inhabitants into bitter enemies of every white man. The bushrangers he exterminated, partly by hunting down those already abroad, partly by cutting off the supply at its

source—Macquarie Harbour and the worst of the assigned convicts. When it became clear that this action had come too late to restore friendly relations with the blackfellows, he took the only course that seemed still open, that of segregating them. In these ways he came into conflict not only with the self-seeking aims of influential colonists, but also with the new philanthropics of the era—which sought to extend the rule of a revivifying kindness over convict and blackfellow alike. And the philanthropists, noble-souled but occasionally intolerant of actual facts, have had most to do with telling Arthur's story; nor have they always extended their kindness to him. He had faults, no doubt, and made mistakes, some of them grave. But the moral of them is not that he was a monster or a tyrant: it is, rather, that the British transportation system could not be satisfactorily administered even by a man of his calibre. Against the mistakes he made in Tasmania we must set the fine achievement of his later governorships, which would have been crowned, but for his failing health, with the governor-generalship of India itself. Unselfish, of inviolable integrity, a pre-eminently able administrator, George Arthur stands out among our governors and among Britain's great public servants. (K.H., 1837; Bart., 1841; P.C., 1847.)

Asbestos. This substance has been discovered in all the States except Victoria, but rarely in payable quantities. In New South Wales it has been found to occur near Barraba in the north and Gundagai in the south; the average annual yield for 1920-22 was 723 tons. In Queensland a belt of country between Cawarral and Canoona (south-west of Rockhampton) shows seams, the fibre from which has been found, despite a certain lack of tensile strength, suitable for the manufacture of fibro-cement, sheeting and tiles; but no payable deposit has been located. In South Australia, deposits of the 'mountain leather' and 'mountain cork' varieties have been found at Oollawirra (north-east of Petersburg) and of the blue variety near Eudunda (west of the Murray bend), and Hawker (south-east of Lake Torrens). In Western Australia the fibrous chrysolite variety has been found south-east of Cossack, in the district between the head-waters of the Yule and the Nullagine; the average annual yield for 1920-22 was 191 tons. In 1899 Tasmania produced 200 tons; no more was raised until in 1916 her chief deposit was located at Anderson's Creek in the Beaconsfield goldfield (west of the Tamar); this in 1918 yielded 2854 tons, valued at over £5000, but latterly the yield has fallen off. The average quantity produced annually in Australia in 1920-22 was 916 tons.

Asclepiadaceae, a large family (chiefly tropical or subtropical) of herbs, trees or twiners, usually exuding a milky juice. Fifteen genera, comprising 68 species, are indigenous. The leaves are entire; flowers in small clusters. The genus *Marsdenia* has 15 species, chiefly climbers. *M. Leichhardtiana* is the 'carcula' of the aborigines of central Australia; they eat (either raw or roasted) the milky unripe fruits, which are about the size of an acorn. *Sarcostemma australe* (the Caustic Vine of Queensland) is a leafless climber with fleshy stems, the leaves being replaced by minute scales. It is suspected of being poisonous to stock. Its milky juice has been used as a healing application to wounds.

Ash, a name popularly applied to several indigenous trees outside the genus *Fraxinus,* which is not represented in Australia. For Brush Ash see RUTACEAE; for Crow Ash, URTICACEAE; for Elderberry Ash, ARALIACEAE; for Prickly Ash, ORITES; and for Red Ash, RHAMNACEAE.

Ashton, JULIAN ROSSI, born at Penzance in Cornwall in 1851, and at the age of 13 placed in the civil engineering branch of the Great Western Railway, employed his spare time in study at the West London school of art (a branch of South Kensington) and, having accumulated savings from work done for *Cassell's Magazine* and other periodicals, in 1871 went to Paris and joined the newly-established Académie Julien. After a second period of work in London, during which he had several small paintings in the Royal Academy exhibitions, he migrated in 1878 to Melbourne to work for the *Illustrated Australian News* and the *Australasian Sketcher.* In 1883 he came to Sydney, and for the next three years toured Australia making sketches for the *Picturesque Atlas of Australia;* then he settled in Sydney, and became a prominent figure in the art world there. In January 1889 Henry Parkes made him a trustee of the national art gallery of New South Wales, and he forthwith used his influence to have Streeton's 'Still Glides the Stream' bought for the gallery, thus recognizing the value of that artist's work six years before the Melbourne gallery did. He was president of the Art Society of New South Wales from 1886 to 1892, and of the Society of Artists in 1897-8 and (after its resuscitation) in 1907-21. In 1899 he resigned his trusteeship of the gallery in order to gain fuller independence as a critic of contemporary art, but maintained his personal influence on the artistic life of the community: it was mainly through his efforts that (*a*) a scholarship of £150 a year was awarded in 1900 to George Lambert (q.v.) to pursue his art studies in Europe, (*b*) £250 was spent by the New South Wales government in 1902 on procuring a permanent artistic record of certain older streets of Sydney which had never been modernized, (*c*) the now undoubted if bizarre genius of Norman Lindsay was given its chance in 1907 as Streeton's had been in 1890. Of Ashton's own work the outstanding examples are his portrait of Henry Parkes (1890) in the Sydney gallery (a replica is in the federal parliament house at Melbourne) and those of Henry Gullett and Archbishop Kelly. W.M.

Assignment System, a form of service under which convicts were allotted as servants. The first free settlers, who arrived in New South Wales early in 1793, received small grants of land, under a condition (among others) that 'the service of convicts should be assigned to them free of expense, such convicts to have two years' rations and one year's clothing.' Phillip at first suggested that this privilege should be limited to the first fifteen settlers; subsequently, however, the system developed into one under which the services of convicts might be obtained by anyone who could feed and clothe them, and by 1804 was so fully taken advantage of that the governor could not get enough to carry out indispensable public works. By Darling's time assignment to persons living in Sydney had become a scandal, as it gave the convict practically the privileges of a free man after working hours; moreover, the wives of convicts had been coming out as free settlers and ar-

ranging that their husbands should be assigned to them. In 1827, therefore, the system was restricted to up-country assignments, and assigned convicts and their wives were forbidden to keep shops or engage in any form of salesmanship. In 1837 Bourke was ordered to consider the probable effects of a cessation of the system; from 1 January 1839 it was severely restricted, and in 1841 was abolished altogether. See CONVICTS.

Astelia, a small genus of the family Liliaceae, extending to New Zealand, the southern extremity of South America, and the Antarctic, includes chiefly alpine herbs that frequently grow in bogs, occasionally (especially in the New Zealand species) epiphytal, densely tufted, and clothed more or less thickly with long silky hairs. The leaves have bases sheathing the stem; fruit a globular berry. The pyramidal sprays of unisexual flowers are shorter than the leaves, loosely branched in the male and densely packed in the female clusters. *A. alpina* is the only indigenous species.

Asthma Herb. See EUPHORBIA.

Astroloma, a genus of the family Epacridaceae, endemic in Australia, and found chiefly in western areas. The succulent drupes of several species are edible, and are known in New South Wales as 'ground berries,' in Tasmania as 'native cranberries;' they have a viscid, sweetish pulp. *A. pinifolium* is a low, diffuse plant, densely covered with cylindrical leaves like pine-needles. The flowers are reddish, shading to yellow.

Astronomy. The record of astronomical observations made on Australian soil during the 50 years after the landing of Captain Cook consists almost entirely of the determination of geographical positions by navigators and explorers distinguished in early Australian history. Governor King, however, records that Baudin in 1802 'prolonged his stay to observe the transit of Mercury,' which took place on 9 November.

The longitude of Fort Macquarie (Sydney) is one of the astronomical results of this period to which much interest and importance have been attached—perhaps because for many years afterwards this point was adopted as the origin of Australian longitudes. In 1788, shortly after the arrival of the 'first fleet,' a small observatory was erected on Dawes Point under the direction of Lieutenant Dawes of the marines, who had been sent by the British board of longitude to make astronomical observations. The first building was of wood, but was soon replaced by a substantial stone structure. This may be regarded as the first observatory established in Australia solely in the interests of astronomy. In 1791 it was equipped with a transit instrument sent out by the British astronomer-royal. The building still exists, but is not used for astronomical purposes.

Matthew Flinders, among his numerous and important geographical observations, determined the latitude and longitude of Dawes Point, the latter with an error (as shown by the latest computations) of 2 seconds only. In 1821 Sir Thomas Brisbane, failing to obtain the support of the British government, erected and equipped at his own cost an observatory at Parramatta. Among the instruments he provided were a transit instrument (by Troughton) of 3¾ inches aperture and 64 inches focal length, a mural circle (also by Troughton) 2 feet in diameter with telescope of the same length, a 16-inch repeating circle (Reichenbach), a 46-inch achromatic telescope (Banks), clocks, chronometers, and other minor appliances. The four instruments first mentioned are still in the Sydney observatory: H. C. Russell called them 'large but essentially faulty.' For use during the solar eclipse of September 1922, the repeating circle was, however, cleaned and transformed into a modern portable almucantar with a self-registering transit micrometer.

Brisbane had already engaged two assistants —Carl Rümker (q.v.) and James Dunlop (q.v.). His main object was to determine the position of stars (down to the eighth magnitude) between his zenith and the south pole. Observations were begun on 2 May 1822, and were continued by himself and his assistants until 16 June 1823; then Rümker left the observatory, but stayed on in Sydney. Brisbane finding himself over-occupied with public affairs, Dunlop worked for the most part by himself until 2 March 1826. Four years later the records were placed in the hands of William Richardson of the Greenwich (England) observatory, who constructed from them the well-known Parramatta Catalogue of 7385 stars for the equinox of 1825; this was published in 1835. The frontispiece of this work is a sketch and ground-plan of the Parramatta observatory. When Brisbane returned to England at the end of 1825, he left his instruments behind at the request of the legislative council: they were subsequently purchased by the colonial government at his own valuation. In March 1826 Dunlop left the observatory. But the work there now became of more immediate public importance, the Royal Society (of London) having proposed to the British government that an arc of the meridian should be measured in New South Wales; and Darling's executive council in July 1826 appointed Rümker to take charge of the observatory, with orders to proceed immediately with this admeasurement. On 21 December 1827 Rümker became the official astronomer of the first government observatory in Australia. He left the country in 1828 on leave, but while away threw up his appointment and became director of the Hamburg observatory. For three years after his departure the observatory remained inoperative; but in 1831 Dunlop was made superintendent, work was resumed in 1832, and continued under him for 16 years. On his retirement in 1847 the observatory, which had become much dilapidated, was closed and dismantled, the instruments being stored.

The results of Rümker's work (published in the *Transactions* of the Royal Society of London (1829), and the *Memoirs* of the Royal Astronomical Society of London, vol. iii) include the rediscovery of Encke's comet at its first predicted return on 2 June 1822, the discovery of a new comet (1824 I) on 15 July 1824, and many observations for latitude and longitude. Between 1826 and 1828 Dunlop at his own house in Parramatta was observing nebulae, clusters, and double stars, with a reflecting telescope of 9-inch aperture, constructed by himself; a catalogue of 629 southern nebulae and clusters and a catalogue of 253 southern double stars were published in the *Transactions* of the Royal Society of London (1828) and in the *Memoirs* of the Royal Astronomical Society, vol. iii. Dunlop continued his determinations of star-positions from 1831 to 1847; his records are contained in eight manuscript books now

at the Sydney observatory. On 30 September 1833 Dunlop, now back at the government observatory, discovered a comet, and on 13 March 1834 independently discovered another which had first been seen by Gambart at Marseilles 12 days before. In 1880, when the building which had once been the Parramatta observatory was fast disappearing, the colonial government erected a marble obelisk on the spot formerly occupied by the transit instrument.

Sydney observatory was built on the recommendation of Sir William Denison. Dunlop had recommended a site on the heights of North Shore, but Flagstaff Hill was selected on account of its great convenience for giving accurate local time to ships in the harbour by means of a time-ball signal. The first equipment consisted of the Parramatta instruments, which, but for the appeals of Phillip Parker King, would have been taken back to England and sold by the British authorities. The first director was W. Scott who had been selected for the post by the astronomer-royal, Sir George Airy; he arrived in Sydney on 1 November 1856, but was not able to begin regular observations until June 1858, when the observatory building was completed. The instruments were in poor order, and when Donati's comet appeared (in October 1858) it was found that the colony's astronomer had nothing but a sextant wherewith to observe it. To remedy the defect a Merz achromatic telescope, equatorially mounted (7½ inches aperture and 124 inches focal length), was purchased by the government and installed in 1861—just in time to observe the great comet of that year.

Scott resigned on 30 September 1862. John Tebbutt (q.v.) having refused the position, George Roberts Smalley was selected by Sir George Airy, and reached Sydney on 7 January 1864. Henry C. Russell (q.v.), who had been Scott's assistant since 1859, had charge of the observatory in the interval. In the period 1862-1870—the meridian instrument being very imperfect, and no other obtainable—the work of the observatory was limited to routine observations of 'clock' stars (for time), observations of the moon and moon-culminating stars (for longitude), and occasional observations of comets. Smalley devoted the greater part of his time to terrestrial magnetism, meteorology, and the initiation of a trigonometrical survey of the colony (see GEODESY).

The directorate of H. C. Russell, which began in 1870, inaugurated an era of reform and progress. A large achromatic equatorial telescope by Schroeder, with a fine object-glass (11¾ inches aperture, 12½ feet focal length), was erected in 1874; three years later a new transit circle by Troughton & Simms (6 inches aperture, 85 inches focal length) was added to the observatory equipment. With these new instruments a programme of work, comprising determination of star-positions and observations of double-stars, was carried on for many years, the result being published in three separate volumes —*Astronomical Results* for 1877-78 and 1879-1881, and *Double-Star Results*, 1871-1881. The *Memoirs* of the R.A.S., vol. 50 contain double-star results for 1882-1889. Other double-star results for subsequent years have been published in various lists in the *Astronomische Nachrichten* (Nos. 3154, 3240, 3303, 3369, 3423).

Work on the Sydney astrographic zones (see later on in this article), and meridian observations of reference stars in those zones, have practically absorbed the whole of the astronomical activities of the Sydney observatory since 1892. Russell retired in 1904; Alfred Henry Lenehan, who had been chief assistant for many years, filled the position till his death in 1908; then W. E. Raimond had charge of the observatory for four years, and in August 1912 W. E. Cooke (formerly director of the Perth observatory, Western Australia), was appointed government astronomer of New South Wales, and professor of astronomy at the university of Sydney. Under his directorship the astrograph has been much improved, and the international work (which had been languishing) has been reorganized and is vigorously prosecuted. Transit observations have been remodelled in accordance with the recommendations of the 1909 international congress, and publication of the catalogues connected with the astrographic scheme has been commenced.

Williamstown observatory.—In 1853 R. J. L. Ellery was appointed by the government of the colony of Victoria to establish a small observatory at Williamstown, chiefly in order to supply accurate time to shipmasters in Hobson's Bay. A time-ball apparatus had already been installed for the purpose, on a tower at Point Gellibrand; the first time-signal was issued in August 1853, observations being made at first with a sextant. In 1854 a 25-inch transit instrument and a good astronomical clock were obtained from England, and in 1866 a more ambitious transit instrument by Troughton & Simms (aperture 3½ inches, focal length 45 inches) was installed. In 1858 a geodetic survey of the colony was decided upon, and placed in charge of the astronomer. The observatory having by this time acquired considerable importance, a board of visitors was appointed by the governor-in-council on 30 January 1860, to report to the government upon the work of the observatory and make recommendations for its efficiency. In 1861 observations were commenced with a new Troughton & Simms transit circle (object-glass of 5 inches aperture, 72 inches focal length), with a circle 4 feet in diameter, divided to every 5 minutes and read by 4 microscopes. A Troughton & Simms achromatic telescope (4½ inches aperture, 5 feet focal length) equatorially mounted, and other instruments, including an Airy zenith sector and a chronograph, were obtained about the same time. In 1863, the site at Williamstown having become unsuitable for astronomical observations, the observatory was removed to the Domain park (four miles north-east from Williamstown, and 1½ miles south-east from the centre of Melbourne) where a new building had been erected for it.

The work of the Williamstown observatory is published as *Astronomical Observations*, 1861-3. It contains a catalogue of 546 stars, a series of right ascensions and north polar distances of the moon—upon which the longitude of the observatory was then based—and a series of observations of Mars and comparison stars at its opposition of 1862.

Melbourne observatory (i.e. that in the Domain park) was ready to commence work at the end of June 1863, when it absorbed the magnetic and meteorological observatory on Flagstaff Hill (at the west end of Melbourne) whose founder and director, George Neumayer, had decided to return to Europe. Ellery took charge of the new observatory. For the first few years astronomical observations were limited to the requirements of the geodetic survey of the colony; but in 1866 the observatory took up a share of the observations for a southern *dürch-*

musterung, proposed by the Royal Astronomical Society of London, which was to be carried out on the same scale as Argelander's *dürchmusterung* for the northern hemisphere. The zone allotted to Melbourne was included between 60° and 80° of south declination. The results of this work, which continued for six years, comprise the mean places, for the equinox of 1875, of 48,672 stars down to the 9th order of magnitude; but these have never been published. Grubb's 4-foot Cassegrain reflector was installed in 1868. The optical dimensions of this instrument are as follows: aperture of primary mirror 4 feet, focal length 360 inches; aperture of secondary mirror 8 inches, focal length 74.7 inches; equivalent focal length of the combination, 1994 inches. The mirrors, of which there is a spare set, are of speculum metal. For about 20 years it was employed mainly in the systematic revision of southern nebulae discovered by Sir John Herschel at the Cape of Good Hope. The first instalment of an account of these observations is given in *Southern Nebulae*, Part 1, issued by the observatory in 1893. In 1874 a photoheliograph by Dallmeyer was acquired for the transit of Venus of that year. It has an aperture of 4 inches, and 60 inches equivalent focal length, and can be adjusted to give good photographic images of the sun from 4 inches to 8 inches in diameter. For many years this instrument took daily photographs of the sun. In the same year two new equatorial telescopes were installed; one by Cooke & Sons of York with an achromatic object-glass (4½ inches aperture, 60 inches focal length), the other by Troughton & Simms (8 inches aperture, 110 inches focal length). The latter telescope was permanently mounted in a separate building erected for it on the observatory grounds, and has since (and throughout) been used for observing comets and double and variable stars, and for micrometric measurements. Spectroscopic observations of the sun and of some 300 southern stars were also made with it.

But meridian observations, for time and determinations of star-positions, always formed the most important part of the routine work of the Melbourne observatory; they were made with the 5-inch transit circle from 1861 to 1883, and the results were published in *Melbourne Observations*, vol. i, and in two star-catalogues. In 1884 a larger transit circle (by Troughton & Simms) was installed, and since then all meridian work has been done with it. This instrument is of dimensions and design similar to those constructed for the observatories of Cambridge (England) and Harvard. Its object-glass has 8 inches clear aperture and 108 inches focal length. Its two circles are 3 feet in diameter. The first results of observations made with this instrument are contained in the third *Melbourne Star Catalogue*, for the equinox of 1890, which has been published; two other catalogues, for epochs 1900 and 1910, which contain all the reference stars of the Melbourne astrographic zones, have been prepared but have not yet been published.

Ellery retired in June 1895, and was succeeded by P. Baracchi, who resigned his position in August 1915. Dr. J. M. Baldwin is the present director.

Adelaide observatory.—In 1855 Charles Todd (afterwards Sir Charles) was appointed superintendent of telegraphs and astronomical observer for South Australia. It was not till 1874, however, that a suitable observatory and some astronomical equipment were provided for him by the South Australian government. The instruments comprised, at first, an equatorial telescope with achromatic object-glass (8 inches aperture, 10 feet focal length), and the 3½-inch transit instrument originally used at the Williamstown observatory. This had been lent to Todd in 1867 by the Victorian government for use in determining the position of the 141st meridian, which is the boundary between Victoria and South Australia; Todd employed it to observe clock-stars in the vicinity of that meridian, and afterwards installed it in the Adelaide observatory, where until 1880 it was used for the determination of local time. Besides this, a time-ball apparatus was fitted on a tower at the Semaphore, 9 miles away; the first signal was issued on 2 August 1875. In 1880 the observatory was provided with a transit circle by Troughton and Simms (6 inches aperture, 85 inches focal length) provided with two circles of 30 inches diameter. The observations which have been made with this instrument, in addition to the ordinary clock-star observations, relate mainly to special investigations of latitude and reflection, and include an extended series of stars in Weisse's catalogue in the belt between 0° and 4°, south declination. Most of the work done with the 8-inch equatorial telescope consists of observations of the surface details of the planet Jupiter, the phenomena of Jupiter's satellites, and comets. The present programme is (*a*) time determinations, (*b*) observations of reference stars of the Sydney astrographic zones, (*c*) field latitudes and longitudes, (*d*) variable and double stars, (*e*) miscellaneous observations.

Sir Charles Todd retired in 1906, and was succeeded by R. F. Griffiths, who resigned in 1908 to join the newly-created federal weather bureau. Since 1909 G. F. Dodwell has held the position.

Perth observatory originated in 1896 as a branch of the colonial secretary's department, W. E. Cooke being appointed director. It is situated on Mount Eliza, a sandhill 200 feet above sea-level, overlooking the city of Perth. The equipment consisted of an 8-inch reflecting telescope intended for use with a coelostat, another reflecting telescope of 12 inches aperture, a transit circle by Troughton & Simms (6 inches aperture, 71 inches focal length) provided with two divided circles of 30 inches diameter, a standard twin astrographic telescope by Grubb, two machines for the measurement of astrographic plates similar to those in use at Oxford and Greenwich, clocks, chronometers, etc. The first few years were devoted chiefly to instrumental investigations and observations for latitude and longitude and routine meridian observations for time. After 1900 the activities of this observatory were almost entirely absorbed by astrographic work and collateral determinations of the places of reference stars, which work was completed and published recently. In 1912 Cooke resigned his position to take up duties at Sydney. Since then H. B. Curlewis has been in charge.

Brisbane observatory.—In 1879 the Queensland government purchased the outfit of a private observatory owned by the late Captain O'Reilly, and removed it to a site on Wickham Terrace. It comprised only a small transit instrument, a chronograph, two clocks, and two chronometers. In 1921 it was temporarily removed to the Insurance Building in George-street (lat. 27° 28′ 23.00″ S., long. 10h. 12m. 6.48

sec. E.) as the earlier position was rendered unsuitable by the erection of private buildings adjacent to it and on the meridian of the transit instrument.

The astronomical work, which has been carried on by officers of the survey department under the direction of the various surveyors-general, has been confined to meridian transit observations for time for public purposes, and for the determination of the longitudes of many places whose positions were required for the compilation of maps. A sidereal clock and chronograph are employed for recording electrically times of transit and receiving time-signals from distant stations. Time-signals are also transmitted to public and other institutions.

Hobart observatory.—In 1840 Sir James Ross (then engaged on his antarctic expedition) established at Hobart a magnetic station and astronomical observatory equipped with a transit instrument, altazimuth and clocks. The building was near government house, and was in charge of Lieutenant Kay, R.N., Sir John Franklin (then governor) assisting with the magnetic observations. Observations were continued until 1854. In 1882 Captain Shortt was appointed government meteorologist, and established an observatory at the military barracks, providing it with a transit instrument, a small equatorial and two clocks; this observatory issued a time-ball signal daily at 1 p.m. until 1911, since when the signal has been supplied directly by the Melbourne observatory.

Mount Stromlo observatory.—In 1910 a committee was appointed by the Commonwealth government to select a suitable site within the Federal Territory for the erection of a temporary observatory to house a Grubb equatorial reflecting telescope (9 inches aperture, 135 inches focal length) which had been presented to the Commonwealth by James Oddie of Ballarat. The selected site was Mount Stromlo, about seven miles from the centre of Canberra. A substantial structure of concrete was built, supporting a revolving dome 18 feet in diameter, under which the telescope was mounted on a solid masonry pier. During 1912 and 1913 a series of observations—visual, telescopic and spectroscopic—was made, including the examination of close double stars, details of planetary surfaces, and solar prominences; and long-exposure photographs of selected regions of the heavens were obtained with a 6-inch Voightlander portrait-lens attached to the telescope. Baracchi reported that Mount Stromlo was decidedly suitable for the projected observatory; the temporary observatory was then closed, and the establishment of a permanent observatory had to be postponed owing to the outbreak of war. In 1922-3, however, the matter was again mooted, and on 1 January 1924 Professor W. G. Duffield, D.Sc., was appointed director. Dr. Duffield (who is a South Australian, trained at the universities of Adelaide and Cambridge, and was in 1909 appointed professor of physics at the university of Reading) has secured two valuable gift telescopes, one of which, presented by J. H. Reynolds of Birmingham, is a reflector exactly similar to that at the Helwan observatory in Egypt, and will be the most powerful instrument in Australia except the Cassegrain reflector at Melbourne. Its mirror is 2½ feet in diameter. The second telescope, a six-inch refractor, was presented by James Oddie. The Stromlo observatory will have attached to it two assistants and a research fellow.

Non-official Astronomers.—John Tebbutt (q.v.) began to make astronomical observations in 1854, and continued them in his private observatory at Windsor, New South Wales, for 60 years. Francis Abbott in 1855 erected a small observatory at Hobart, where for some years he made systematic observations for local time, as well as observations of comets and variable stars, with a Cooke achromatic equatorial telescope of 3½ inches aperture. In 1862 he added to his outfit a better transit instrument by Dallmeyer, an achromatic equatorial telescope by the same maker (4½ inches aperture, 5 feet focal length), and, shortly afterwards, a larger equatorial by Dollond (7 feet focal length). He specialized in comets—'1865 I' was discovered by him one day before Moesta saw it at Santiago—and in observations of the variable star Eta Argus. T. O. Smeaton and F. G. Singleton at Adelaide observed the 1874 transit of Venus with achromatic telescopes of 3½ and 3 inches aperture, and A. W. Dobbie with an 8½-inch reflector. Dobbie, who was an observing member of the Mars section of the British Astronomical Association, constructed his own reflectors, and in 1905 completed one of 18 inches aperture. W. J. MacDonnell was already in 1871 making systematic observations at Port Macquarie with a Grubb achromatic telescope of 6 inches aperture. Later he removed to Sydney, where he continued astronomical work with a smaller equatorial by Parker (4½ inches aperture). He was one of the official party who at Eden, New South Wales, observed the transit of Venus of 1874, and one of the observers of the Jupiter section of the British Astronomical Association, in whose *Journal* and *Memoirs* most of his work was published. G. D. Hirst, well known for his remarkable skill in planetary drawings, is one of the prominent observers of the Mars and Jupiter sections of the British Astronomical Association. His principal instrument is an achromatic telescope (4½ inches aperture) by Cooke & Son. His work, which extends over 40 years, comprises studies of the details of planetary surfaces and observations of comets and double stars.

Between 1880 and 1890 several amateur makers of reflecting telescopes were at work, including R. W. Wigmore and R. Shafer of Melbourne, M. Watt, M. Corbett, M. F. Madsen and Walter Gale of Sydney. Among the observers of this period A. B. Biggs used an 8½-inch reflecting telescope and a 3½-inch achromatic telescope; his observations were chiefly on comets. Dr. Bone mounted in 1882 at his private observatory at Castlemaine (Victoria) a fine equatorial telescope by Grubb (object-glass of 8 inches aperture), but he died shortly after, and his telescope was purchased in 1887 by John Tebbutt. In 1887 a private observatory, Mount Pleasant, was established by James Oddie at Ballarat. The principal instruments were a reflecting telescope (26 inches aperture) and another Newtonian reflector (12 inches aperture); the mirrors for both telescopes were made by Captain Baker, whom Oddie had placed in charge of the observatory. Other Victorian observers of note are David Ross, who discovered two comets ('1883 II' and '1906 II') and T. E. Davidson, who discovered the comet '1889 IV.'

Walter Frederick Gale, one of the most skilful observers in New South Wales, commenced to make his own reflecting telescopes in 1882, while still a student. In 1892 he made observations of Mars with an 8½-inch reflector by With, and his four drawings of the planet were repro-

duced in the *Memoirs* of the British Astronomical Association. He is said to have been the first to note the delicate markings, now known as 'oases,' recorded also by Pickering, and later by Lowell, Flammarion and Antoniadi. The *Memoirs* contain the results of Gale's numerous observations of Jupiter and its satellites. He has independently discovered six comets, two of which bear his name—Gale 1894 II, and Gale 1912 I; Sawerthal (1888 I) was seen by Gale independently only one day after Sawerthal discovered it at the Cape of Good Hope; the other three proved to be the returns of Fabry 1886 I, Winnecke 1892 IV and Tempel[2] 1894. He has also discovered several double stars and a ring nebula.

In the nineties R. T. A. Innes, now director of the Natal observatory, and J. C. Merfield, now chief assistant at the Melbourne observatory, were conspicuous. Innes, with a 6½-inch equatorial refractor and a Newtonian reflector with mirror 16 inches in diameter, made systematic observations of variable stars and double stars. Merfield for many years made observations of comets and coloured stars, and was at one time director of the 'coloured stars' observing section of the British Astronomical Association. His instruments were an equatorial refractor (6¼ inches aperture) by Cooke & Son, and a reflecting telescope, with mirror 7 inches in diameter. He had also a small transit instrument. He contributed to astronomical periodicals numerous important papers dealing with the definitive elements of comet orbits, perturbations, and other problems of gravitational astronomy.

Branches of the British Astronomical Association were formed in Sydney in 1894 and in Melbourne in 1897. The Melbourne branch, after a few years of struggle on the part of its few enthusiastic promoters, languished and was dissolved in 1905. The Sydney branch was vigorous, and soon formed special observing sections for comets, planets, coloured stars, sun, and meteors. Some of the observers in these sections have been noted above. Among others who have, by observations or writings, increased astronomical knowledge are Sir George Knibbs (q.v.) who succeeded John Tebbutt as second president of the branch; Thomas Roseby, a fluent writer on astronomical subjects, who was twice president; H. F. Marsden, who wrote a valuable paper on the construction of a reflector of 18 inches aperture; T. M. Close, who computed comets' orbits and lunar occultations by graphical methods, and prepared astronomical data for observers (as did also Innes and Merfield); and Hugh Wright, ex-president of the branch and member of the observing sections Mars and Jupiter, who with a Newtonian reflector (8½ inches aperture) by Browning has made many observations on coloured stars, double stars, nebulae, solar spots, meteors, planets, and comets. The Astronomical Society of South Australia originated in 1892 as a branch of the Royal Society of that State. It is intimately connected with the Adelaide observatory, and the work of its members is published in the transactions of the society.

Astrophotography.—The Paris Astrophotographic Congress of 1887 resolved on the production of an international catalogue and chart of the heavens, the work of which was to be shared among 16 observatories scattered about the world. H. C. Russell, who was present from Australia, was authorized by the governments of New South Wales and Victoria to nominate the Sydney and Melbourne observatories as two of the 16. To Sydney was assigned the region between 57° and 64° declination south; Melbourne took that between 65° south and the south pole. In 1900 the Perth observatory came into the scheme, and was given the region between 31° and 41° south declination, originally assigned to the Rio de Janeiro observatory. Special instruments (twin telescopes, usually known as astrographs) of a form and dimensions prescribed by the congress, were installed at Sydney and Melbourne. The latter, by Grubb, reached Melbourne in 1891, and was mounted in a special building erected for it in the observatory grounds. The Sydney astrograph (except the Steinheil object-glass) was made in Sydney under Russell's personal supervision; while he was waiting for the object-glass, he mounted on the instrument a Dallmeyer star-camera (6 inches aperture, 32 inches focal length) and took a series of long-exposure photographs of the Milky Way. An album published in 1890 contained 17 of these, with descriptions.

Astronomical Expeditions.—On six occasions Australian expeditions have been organized for the observation of astronomical phenomena:—

1. Total eclipse of the sun, 11 December 1871. An expedition to Eclipse Island in northern Australia was organized and conducted by Ellery and Russell, as directors of the Melbourne and Sydney observatories. The weather was unfavourable, and the results unsatisfactory.

2. Transit of Venus, December 1874. Four separate parties were organized by Russell and placed at Eden, Goulburn, Woodford (on the Blue Mountains) and Sydney. Tebbutt observed the transit at Windsor. Ellery sent out three parties, to Mornington, View Hill (near Bendigo), and Glenrowan, and observed the transit himself at Melbourne. In South Australia it was observed by Todd and Singleton at the Adelaide observatory, and by Smeaton and Dobbie at their homes in the suburbs. Although at several stations cloudy weather interfered with the observations, yet on the whole results were good, and formed an important part of the investigation of the solar parallax based on the general results obtained from this transit.

3. Transit of Venus, 7 December 1882. Russell sent out five parties, to Port Macquarie, Clarence River, Dromedary, Katoomba, and Lord Howe Island: all were unsuccessful, owing to bad weather. Tebbutt at Windsor and Russell himself at Sydney were similarly disappointed. From Victoria Ellery sent a party to Hobart in Tasmania, locating another at Sale in Gippsland. The Sale party failed through bad weather; the Hobart party, and Ellery himself at Melbourne, did well. Todd observed the transit successfully at Wentworth on the Murray.

4. Total eclipse of the sun, 10 May 1890. An expedition to Bruni Island in Tasmania was organized by Baracchi under the auspices of the Australasian Association for the Advancement of Science, but nothing was seen of the eclipse, owing to cloud and rain.

5. Total eclipse of the sun, 29 April 1911. This was observed with fair success at Vavau (an island of the Tonga group) by an expedition organized by the Australasian Association aforesaid, conducted by Baracchi, and subsidized by the Commonwealth government.

6. Total eclipse of the sun, 21 September 1922. This eclipse was expected to give excellent opportunities for testing the validity of Einstein's theory of relativity; and, as the line of totality crossed Australia from east to west, expeditions from British and American observatories were organized to conduct observations at

several stations in the Commonwealth, besides those sent out by Australian observatories. The most favourable view-point, meteorologically as well as astronomically, was at Wallal (Wollal) on the Ninety-mile Beach, about half-way between Broome and Roebourne in Western Australia. Here foregathered five parties — the Crocker eclipse expedition from the Lick Observatory in California (which included the government astronomer of New Zealand), the Toronto University expedition, an Indian party from the Kodackanal observatory at Madras, a private party from England, and the official expedition from the Perth (W.A.) observatory under Charles Nossiter. The Adelaide observatory sent a party to Cordillo Downs in the far north-eastern corner of South Australia. The other expeditions stationed themselves along the southern border of Queensland—those from the university of Sydney and the Sydney and Melbourne observatories at Goondiwindi, one from the New South Wales branch of the British Astronomical Association at Stanthorpe on the inter-State railway line, and an observer from the terrestrial magnetism department of the Carnegie Institute of Washington, U.S.A., at Coongoola, a little north of Cunnamulla. The weather conditions during totality were excellent at all these stations, and valuable observations were made and photographs taken, those secured at Wallal being of course the most important both from the suitability of the station and the prominence of the observers. When the results could be co-ordinated, it was announced by some authorities that Einstein's theories had been decisively confirmed; but later discussions of them leave this statement still unproven.

P. B.

Atalantia. See EREMOCITRUS.

Atalaya, a genus of the family Sapindaceae, endemic in Australia except for one species. There are five indigenous species, chiefly eastern; they are trees or shrubs, with large leaves divided into leaflets, small flowers in sprays, and winged fruits. *A. hemiglauca*, best-known as Western White-wood (the 'boorbal' of the aborigines), is a small tree of 30-40 feet, well represented on the western plains, where it is ranked as one of our best fodder-trees. It is easily propagated from seeds, and should be largely planted in arid districts. It has a scaly, friable bark, and a white or pale yellow fissile timber. It exudes a useful pale-coloured gum.

Atkins, RICHARD (1745-1820), born in England in 1745, was the fifth son of Sir George Bowyer, but took the name Atkins under the provisions of a will. He entered the army, but little is known of his career there, except that in 1783 he was adjutant of the Isle of Man militia. After retirement he came to New South Wales with Grose, reaching Sydney on 14 February 1792, and was almost immediately selected by Phillip to be registrar of the vice admiralty court. When John Macarthur resigned his position as inspector of public works in February 1806 Hunter put Atkins into his place; and the personal enmity which characterized the relations of the two men burst into a flame that did not die down while Atkins lived. Atkins wrote abusive letters to Macarthur, which he afterwards showed to successive governors. Macarthur made grave accusations against Atkins in a letter to Lord Portland, then colonial secretary; tried to prosecute him criminally for libel when in 1796 Hunter (under orders from the colonial office) made him acting judge-advocate during the absence of Collins in England; and later based on a charge of his unfitness for his position the proceedings which ended in the 'Bligh rebellion.' Atkins acted as judge-advocate until in 1798 Richard Dore came out with a commission from England, was made deputy judge-advocate when Dore died in 1800, and in 1802 attained the full position—chiefly, it would seem, because no more suitable person was available; King was not content with his modicum of legal knowledge, and Bligh had a very poor opinion of him. He also held the posts of magistrate (since 1792), registrar of imports and exports (1799), and commandant of the Loyal Association at Parramatta (1800) and Sydney (1806).

In January 1808 Macarthur, who had been a thorn in the side of every governor and had quarrelled particularly with Bligh, was summoned to stand his trial for 'deceiptfully, wickedly and maliciously contriving and abetting against William Bligh Esquire.' Atkins, as judge-advocate, was president of the court; but Macarthur protested against him as biassed, malicious and a liar (the epithets are but a feeble summary of the actual words used), and the other six members of the court, all officers of the New South Wales Corps, backed Macarthur, who had been their fellow-officer. It is a sidelight on the character of Bligh that he there and then provoked the famous 'rebellion' by his unhesitating support of an official whom less than three months before he had described to the colonial office as weak, a blabber, a drunkard, ridiculous and in legal matters 'subservient to private inclination.' The remainder of this story will be found under BLIGH, WILLIAM.

It need only be said here that Atkins, suspended from his office by Johnston, was reinstated (very unwillingly) by Foveaux, presided —as by law he was bound to do—at the trial of George Suttor the loyalist, and was in the end replaced on Macquarie's arrival by Ellis Bent. Macquarie sent him to England as one of Bligh's witnesses in H.M.S. *Hindostan*; he gave evidence at the court martial on Johnston, and then retired into obscurity. He died in London on 21 November 1820.

Atkinsonia, a genus of the family Loranthaceae, has one endemic species, *A. ligustrina*, found within a limited area of the Blue Mountains. It is an erect bush of 2-3 feet, terrestrial but root-parasitic; flowers numerous, in short axillary spikes with 6-8 varicoloured petals, dark-reddish to buff; leaves alternate, 1-1½ inches long; fruit ovoid, scarlet, 3-4 lines long, and highly ornamental.

Atrichornis. See SCRUB BIRD.

Australia, Discovery of, and Early Voyages to.

Portuguese and Spanish period.—After the discovery of the New World in 1492 the Spaniards still kept up their attempts to reach by the westward route lands and islands of the far East, which they believed to contain strange civilizations and enormous wealth. Cipango, with its golden palaces and untold treasures; Cathay, extolled by Marco Polo; the marvellous spice-bearing islands—these were the objects of their search, as they had been of that voyage of Columbus which accidentally and unavoidably brought him to the American continent. The

Portuguese, meanwhile, voyaging in the opposite direction, rounded the Cape of Good Hope, reached first India, then Malacca and Java, and by 1526 had followed the chain of the East Indian Archipelago to New Guinea. These two nations by a series of bargains proceeded to divide the new world between them. A grant made by Pope Alexander VI in 1493, slightly modified by the Treaty of Tordesillas next year, drew the line that separated their possessions 370 leagues W. of the Cape Verde Islands (about 50° W., according to the maps of those days): when Spanish ships pushed westward from the American coast across the Pacific, and Spanish explorers began to claim rights of discovery in the Spice Islands, they claimed an extension of this line into the Pacific which would have given the Moluccas and New Guinea to Spain. In 1529, however, an arrangement was reached which pushed the Pacific line 297 leagues east of the Moluccas, thus giving that group entirely to Portugal, while Spain was compensated by letting her retain the Philippines, although they were really within the Portuguese sphere.

Portugal happened to be concerned chiefly with trade, and devoted most of her energies to exploitation, rather than exploration, when once she had fastened her grip on the coast of India and on the Spice Islands. Geographers have always been at a loss to account for the late discovery of the Australian continent, and many —from Alexander Dalrymple to George Collingridge—have toyed with the notion that certain old maps (notably the 'Dauphin' map of 1530 and one made by Jean Rotz in 1542) indicate the discovery of a large part of the Australian coast by the Portuguese before 1542. Those who wish to follow up this scent will find a full and well-documented discussion in Wood's *Discovery of Australia*, pp. 82-129. Apart from these improbabilities, the only important discovery made by a Portuguese (for his own nation) in waters that can be called Australasian was that of the northern coast of New Guinea by Jorge de Menezes in 1524-6; and this was the accidental result of currents, and of his ignorance, rather than his adventurousness. The Spaniards, on the other hand,

were explorers by nature, and in addition were keen to reach new 'spice islands' not yet annexed by Portugal; it is with their expeditions that the exploration of Australasian waters really commences.

The circumnavigation of the world by Magellan's famous ship *Vittoria* (1519-21) during which Magellan was killed in the Philippines, included the traversing of Australian seas from Timor towards the Antarctic, but put no Australian territory on the map. It was followed up, as promptly as was possible in those days, by a series of expeditions from Old and from New Spain. In 1525 Loaysa led several ships from Corunna in Old Spain to occupy the Spice Islands; but storms beset him at both ends of Magellan Straits, and only one vessel reached the goal. Another—a mere pinnace—managed to make the Mexican coast and report to Cortes, who sent his kinsman Alvaro de Saavedra to search for the rest of the expedition. Saavedra reached the Spice Islands in a little over two months, picked up the survivors, took in a cargo of spices, and started back by a route heading south-east, so as to avoid the north-east trades. Consequently he found himself coasting for no less than 250 leagues along the northern shores of an island which he called Isla del Oro; but his description of the natives as woolly-haired and African-looking seems to have induced another explorer (de Retez) 20 years later to rename the island 'New Guinea.' Neither that year nor again at all did Saavedra return to New Spain

Cortes in 1536 sent out Hernando de Grijalva, who sailed from Acapulco to the Isla del Oro, and was murdered by his own crew near Geelvink Bay. But the magic word 'gold' was ever an alluring bait; in 1543 the small *San Juan*, in an unsuccessful attempt to reach New Spain from the Philippines, attached the name of its captain to Cape della Torre just west of the Sepik River; and two years later Ortiz de Retez in the same vessel coasted along New Guinea for 650 leagues and named the principal features he noticed on a plan which almost amounts to a log of the voyage. Striking New Guinea at the Gabo de Deses (now the Cape of Good Hope), he entered on his chart the names 'S. Thiago' (Saint James, whose day is May 1), 'St. Andres' (Saint Andrew, June 23), 'Y. S. Paulo' and 'R. de S. Petro' (SS. Peter and Paul, June 29), 'R. de S. Augustin' (Aug. 28)—now called the Sepik River—and finally 'Ancon de la Natividad de Nuestra Sinora' (Nativity of the Virgin Mary, Sep. 8) now called Cape King William. At this point he left the New Guinea coast, and the islands now known as New Britain and New Ireland are marked, though not named, on his chart.

The next attempt was made from South America. On St. Isabel's day, 19 November 1567, Sarmiento and Mendana sailed from Callao to discover what lay south of the New Guinea coast. Sarmiento wished to steer WSW. across the ocean spaces; but Mendana's fear of the unknown dragged him always northwards, and in February 1568 the expedition found itself off a large island not far from the position laid down for New Guinea. Sarmiento, who was in charge of affairs relating to discoveries, landed, formally annexed the island under the name of Santa Ysabel (the natives, it appears, called it Atoglu), and named his landing-place Baya de la Estrella (Bay of the Star)—a name which has been recently restored to it. Making a long stay in the group, he discovered the islands now called Guadalcanal, Malaita, Florida, Savo, and San Cristobal, and—in view of the riches he hoped to find when more thorough search was possible—called the whole group Islas de Salomon. In September he was back in Callao, excited about his find; but the Spanish authorities, both in Spain and in America, were busy with more immediate needs, and nothing further was done for many years.

From the year 1580, however, a new era of Pacific exploration begins. The unwieldy empire of Spain was being harassed by the English and the Dutch, both at home and on the sea; while the English mariners set themselves to hunt for gold and silver (mainly by the simple expedient of seizing Spanish treasure ships), the Dutch obeyed their commercial instinct and fastened on the ports and islands previously exploited by Portugal, which in 1580 became a province of Spain. Drake in 1579-80 and Cavendish in 1587-8 voyaged through the Pacific, raided in the Malaysian islands, and made their way home by Java and the Cape of Good Hope. Houtman in 1595 took a long-planned expedition round that Cape to Bantam in Java, and within the next seven years 70 Dutch vessels had used the same route. It was obviously time for Spain to wake up, if she wished to retain territory in these eastern waters. Mendana had never quite given up hope of being allowed to revisit the Solomons; in 1595 he was at last let go. Settlement rather than discovery was the object. Three large vessels and a frigate conveyed the expedition, which included the wives of many of the explorers—notably Mendana's wife, Ysabel de Barreto, and Mariana de Castro, wife of Lope de Vega. The chief navigating officer of the expedition was Pedro Fernandez de Quiros (Queiroz, Quir). Leaving Callao on 9 April 1595, with orders to plant a colony in San Cristobal and from that base to explore the surrounding ocean in search of the supposed southern continent, Mendana discovered the Marquesas and on 7 September sighted a new island, which he called Santa Cruz. (This name is now applied to the whole group, Mendana's island being known as Nitendi.) On the 21st the colony was formally proclaimed; but native hostility, coupled with sickness and mutiny among his crew, broke Mendana's spirit. He died there; his widow, with Quiros to help her, brought the remnant of the expedition safely to the Philippines; but Lope de Vega (who must not be confused with the great Spanish writer, Lope Felix de Vega Carpio) and his followers, who had left the main body before it reached Santa Cruz, were never heard of again.

Quiros, however, evidently considered himself in the succession, and took up the work with enthusiasm. He went back to Spain to report to Philip, then to Rome to interest the Pope in missionary work among the newly found tribes. (More than a century later a petition of Melanesian islanders for more missionaries and better administration bases its plaints on the work and promises of 'the good Pedro Fernandez de Quiros, in whose grave our hopes too were buried.') Possibly on this account, more probably because Dutch and English encroachments in the Spanish seas were increasing, Quiros was sent off again from Callao to plant a fresh colony on Nitendi and then go in quest of the 'Continent towards the south.' With two ships and a brigantine, Luis Vaez de Torres (Luiz and Luys, Vaes and Baez, are variants often met with) being second in command, he sailed from Callao in December 1605; but before reaching Nitendi he sighted Taumaco in the Duff group (18 April), and the natives there were so positive about extensive land areas to southwards that he made straight south past Tucopia (21 April) and soon saw in front of him what looked like a great barrier of land—'the eye could not turn to any point that was not all land.' On 1 May 1606 he entered what he described as a great bay, which 'contains twenty leagues of shore, and is surrounded by a large population . . . . The port of Vera Cruz is so capacious that it would contain at anchor a thousand ships.' Seven islands off the port 'subtend two hundred leagues. One of them, about twelve leagues distant, is fifty leagues in circumference.' The land Quiros called 'Austrialia del Espiritu Santo,' the bay 'The Great Bay of Saints Philip and James,' and the port 'Vera Cruz;' and possession was taken of the territory on 10 May (Whitsunday) with the utmost possible religious ceremony. After a month's stay in this spot the expedition sailed southwards (8 June) to discover the extent of the land in that direction; but head winds and mistaken orders now split the fleet in two. Quiros, making back, but told by his pilot that it was impossible to reach the bay and anchor, steered for a pre-arranged rendezvous at Santa Cruz, failed in that also, and in the end returned to Acapulco (3 October). Torres—who gives quite a different account of the separation, with a Spanish noble's sneer at the commoner Quiros

—anchored in the bay, stayed there another fortnight, sailed far enough round the island to prove that it was merely an island, and then made off southwards to pursue the search for the still undiscovered southern continent. He missed it by very little. According to his own account (contained in a letter found 156 years later in Manila) he reached 21° S. lat. not far from the Queensland coast; not sighting land, he turned northwards, found himself tangled up in the islands off the eastern end of New Guinea, worked up into the bight of the Gulf of Papua, and came down again as far as 11° S. lat.—which must have brought him within sight of Cape York and given him a passage through Endeavour Strait. But Torres, it must be remembered, was a Spanish noble not personally interested in exploration and mainly anxious to obey exactly (and to show that he had so obeyed) his king's orders; his letter consists of vague expressions in which are imbedded extracts from his pilot's observations, not always correctly understood by the commander himself; between Espiritu Santo and the Moluccas he does not mention a single name except 'New Guinea,' not even the names which we know from Spanish charts were given by his expedition to certain ports it discovered and explored. Consequently his own account must be checked carefully with charts, whereupon its inaccuracy becomes evident, and the following statement of his journeyings (for which the entire credit is due to Captain F. J. Bayldon, R.N.R., of Sydney) may be taken as authentic:—

Steering south-west from Espiritu Santo to a point about 360 miles north-east of Keppel Bay (Queensland), Torres then turned north-west towards the eastern end of New Guinea as marked on his chart, but found himself unable to round Cape Sudest. He therefore made west along the New Guinea coast, and on his way entered at least three harbours which can be definitely identified—Jenkins Bay (which he discovered on 18 July, as we learn from Spanish charts of the time), Orangerie Bay (10 August), and Triton Bay (18 October). Between Orangerie and Triton Bays he coasted New Guinea to the head of the Gulf of Papua, then skirted a great shoal south-westwards, looking for a passage through it, and through an opening probably just south of Saibai (though some authorities think he went as far south as Banks Island) reached the Arafura Sea. Working back to the New Guinea coast, he passed westwards to Cape False, then north to Cape Steenboom, and so to Triton Bay.

At several points he took formal possession of the land for Spain. But he had no desire to find out any more than was laid down in his orders; 'I doubt' he wrote, 'if in ten years could be examined the coasts of all the islands we descried;' and his long, slow voyage along coral-reefs and mud shoals only increased his longing to be back in the Moluccas as quickly as possible. His adventurous but unlucky voyage ended at Manila in the Philippines—and even then such discoveries as he had made remained unknown. In accordance with the policy of withholding useful information from dangerous competitors, which most nations in those days practised, his diaries were until late in the eighteenth century hidden away in a monastery at Manila, and Torres Straits had to be rediscovered by Captain Cook.

This Quiros-Torres exploration has been described in some detail, because it has of late years given rise to several paradoxical suggestions. One, originated by the late Lawrence Hargrave, was that the truant Lope de Vega reached Port Jackson (where he is supposed to have left rude carvings of himself and family on the rocks), coasted the Australian shores thence northwards to Port Curtis, and was wrecked there. All this story is built up on a few almost obliterated scratches on the rocks of Rose Bay in Port Jackson, and an unconfirmed legend about a Spanish wreck on Facing Island. A second suggestion is that the land discovered by Quiros really was Australia—the chosen spot being, curiously enough, again Port Curtis. This is based mainly on the exaggerations of Quiros himself, who in ten memorials (written in five years) enlarged grandiloquently on the extent and riches of his beloved 'Austrialia.' It is certain that Santo—the island which, according to the best obtainable evidence, he did discover—does not answer to his perfervid description, but this may be excused in an explorer anxious for another job; and all the rest of the evidence—the map drawn by Diego de Prado, the statements of Torres, the latitude given by Quiros himself—supports Santo, and Santo only.

Dutch and English period.—The expedition of Quiros and Torres closes the period of Spanish activity. Quiros set sail again a few years later, still in search of the Great Australian Continent; but he died at Panama on his way out, and by the abandonment of his expedition the Dutch were allowed to remain sole masters of the situation.

It would seem that they did not wish to waste time; for, strange to say, their first claim of Australian discovery coincides almost exactly in point of time with Torres's advent. The locality, also, is that of Torres's unconscious discoveries. In March 1606 (a few months, therefore, before the arrival of Torres) the Dutch yacht *Duyfken* sailed right into the big bay that came to be known in after years as the Gulf of Carpentaria. This voyage of the *Duyfken* (Little Dove) has been so much challenged of late years that it is necessary to go into it in some detail. The account given in the instructions issued to Tasman for his voyage of 1644 (see below) is that 'the unknown south and west coasts of Nova Guinea were discovered over a length of 220 miles, from 5° to 13¾° S. lat.,' that some of the sailors were killed by blackfellows, and that the captain (Willem Jansz) gave the name of Cape Keerweer to 'the extreme point of the discovered land in 13¾ degrees S. lat.' It is this name that seems to have caused all the difficulty. Long after Tasman's time no Cape Keerweer could be found on any chart of the Gulf of Carpentaria: the only cape of that name was shown on the coast of New Guinea in lat. 7° S. The name shown on modern charts, on the western side of the Cape York Peninsula, was put there by Flinders on the authority of the Tasman instructions. Moreover, in an earlier set of instructions issued to Tasman for his 1642-3 voyage, Cape Keerweer is said to lie in 18° S. lat., so that its exact position must have been at least doubtful. But 'keerweer' merely means 'turn back,' and may be found again and again on old Dutch charts, to indicate the point at which some exploring vessel began its return voyage; it is the equivalent of Cook's Cape Turnagain on the eastern coast of New Zealand, and might well occur in 7°, 13¾°, and 18° S. lat. as a result of three Dutch voyages south-eastwards, just as it did on the Celebes coast after a north-eastward exploration. Mistakes about a name like that do not in-

validate the record of an otherwise well-attested voyage.

The earlier evidence for this consists of (*a*) notes in the journal of a certain Captain Saris in 1605-6, mentioning the departure and return of 'a small pinnasse of the Flemmings' sent to make discoveries in New Guinea: (*b*) a series of references to the *Duyfken* by name, in a journal kept by Captain Carstensz of the *Pera* on his voyage through the same waters in 1623-4. These references are frequent and detailed. One of the rivers visited, for instance, is described as the river 'which the men of the *Duyfken* went up in 1606, and where one of them was killed by the arrows of the blacks.' Other manuscripts connected with the Carstensz voyage show that they had charts of the coast along which they were travelling: and these charts could only be those drawn from the *Duyfken's* information. Those who challenge the authenticity of this voyage support their incredulity by alleging that it would be impossible to sail across so wide a gap as Torres Straits without getting some hint that it was a through passage and not merely a bight. But the early discoverers—Jansz of the *Duyfken* and Carstensz—were not, in fact, convinced that it was merely a bight. Carstensz's journal and the 1644 Instructions show clearly that the existence of a strait was suspected: Tasman, for instance, was specially directed to anchor for several days in a certain bay (actually in Endeavour Strait), and make careful search there for a passage to the South Sea, while Carstensz records day by day the events which prevented him from pushing eastwards anywhere in the Torres Straits area. His track can be almost exactly marked on modern charts, and his failure satisfactorily accounted for. Moreover, the failure to recognize the existence of great gulfs, and the tendency to draw lines across their mouth on the chart to signify a coast-line, was common in those days; all early Dutch charts, for instance, show Celebes as a solid island by marking a coast-line straight across from Banka Strait to Greyhound Strait. Finally, the supposed discovery that New Guinea was solidly connected with Australia is definitely claimed by Tasman's second-in-command. On a copy of his chart now in the British Museum there is an inscription (translated, of course, as the copy is an English one), 'This large land of New Guinea was first discovered to join ye South Land by ye Yot Lemmen' — that is, by one of Tasman's 1644 vessels. And the claim could not have been made if any earlier explorers had considered the question definitely settled. There is no reason, therefore, to question the *Duyfken's* voyage. The contemporary account of it is lost, just as is the account of Tasman's 1644 voyage, which is only known to us by a line drawn on a chart. Jansz's voyage was merely an imperfect precursor of the *Pera's*—and we know all about that.

In January 1623, Jan Carstensz or Carstenszoon was sent with the ships *Pera* and *Arnhem* (or *Aernem*) to follow up the tracks of the *Duyfken*. His journal is preserved almost complete, and we can follow his wanderings very accurately. At first he worked along the southern coast of New Guinea, passing False Cape and reaching a point east of the present Anglo-Dutch boundary, and was thankful to escape from the dangerous coastal shoals west again into open sea; he called the shallow area 'Drooge Bocht'—Dry Bight—and turned south with the object of running down to 16° S. lat. before making for home again. On the morning of 12 April he sighted the Australian coast somewhere about 11° S.; on the 15th he attempted a landing in about 15° S., but failed; two days later, however, he landed and went some way inland, capturing a blackfellow (whom he brought back to Batavia) and having several skirmishes with the aggrieved tribe. The discovery of 'great quantities of human bones' convinced him that the blacks were cannibals. On the 24th, in (according to his calculations) 17° 8′ S. lat., he found himself off the swamp-lined estuary of the Gilbert River (he named it Staten Revier), and could get no fresh water; his seaman's instinct warned him that he was approaching the bottom of a bight, with on-shore winds; and it was decided to return. Almost immediately the *Arnhem* deserted, making directly back towards the Aru Islands and discovering on the way that part of the Northern Territory which has since been called Arnhem Land. Carstensz kept steadily up the coast, charting and naming its principal features, rarely discovering fresh water, seeing few blacks but many fires; after a landing in 15° 20′ S. lat. or thereabouts he gave vent to his feelings —'we have not seen one fruit-bearing tree, nor anything that man could make use of; there are no mountains or even hills . . . . this is the most arid and barren region that could be found anywhere on the earth; the inhabitants, too, are the most wretched and poorest creatures that I have ever seen.' However he did get 'plenty of delicious fish' and, a little later, 'excellent vegetables or pot-herbs.' Again and again he landed and attempted to open up communications with the natives, but found them more and more hostile as he went north. At last he anchored well inside the mouth of Endeavour Strait, was blocked by easterly winds from following the coast-line farther, entangled himself in the shallows under Prince of Wales Island, and again escaped westwards with a sigh of fervent thanksgiving. On 15 May he left Australian waters and made back to Amboyna, which he reached safely on 8 June after one of the most thorough and persevering voyages of exploration recorded to the credit of Dutch seamanship. He has been dealt with here over-minutely, perhaps; but the usual accounts of his work are so inadequate and distorted that it seems worth while to do him justice. The results of his voyage were twofold. His account of the country dissuaded the Dutch authorities from any further attempt to exploit those regions; but his account of the Drooge Bocht, both on its northern and on its southern sides, revived their hopes of finding a waterway there into the South Seas—and if Tasman had had one-tenth of Carstensz's pluck or perseverance, Cook's work would have been done 130 years earlier.

The early Dutch cartographical period begins in the year 1627, H. Gerritsz's chart of that date being the earliest known engraved representation of the western coast-line. According to this chart the discoveries made by the Dutch along those shores, in chronological order, are as follows:

1616. Dirck Hartog, commanding the *Eendracht* (Concord), entered Shark Bay on 25 October and examined the coast between 26° 30′ and 23° S. lat. On the northern extremity of Dirk Hartog's Island (Cape Inscription) he set up a post, with a tin or pewter plate on which he recorded his visit.

1618. On 11 May the *Seewolff* sighted land in the neighbourhood of 21° 15′ S.

During July Lenaert Jacobsz in the *Mauritius*, driven out of his proper course, sighted land in 21° 45′ S., and on July 31 landed on an island whose northern point was in 22° S. This cannot be identified; but the Willems River (named after the supercargo Willem Jansz), which was set down on a rough chart recording the discovery, is supposed to be the Ashburton.

1619. On 19 July Frederik Houtman in the *Dordrecht*, one of 11 vessels voyaging together from Holland, sighted land in 32° 20′ S. but was unable to make a landing. Ten days later he came upon 'a level broken country with reefs all round it'—really the rocky islets and outlying reefs which Gerritsz for some reason named 'Houtman's Abrolhos.' The term (which means 'Look out!') is of Portuguese origin; but mariners are polyglot in their way, and the mere use of a Portuguese phrase on a map cannot be strained to carry the weight that some historians wish to place on it. In one of the vessels of Houtman's fleet, the *Amsterdam*, Jacob Dedel was the supercargo, and after him they named the coast between Shark Bay and Champion Bay.

1622. In March the *Leeuwin* (Lioness) rounded the SW. corner of the continent, where a cape now bears her name, and examined the shore as far as King George's Sound. Next year came the voyage of Carstensz already narrated.

On the 16th or 26th of January 1627 (for accounts differ), the *Gulden Zeepaert* (Golden Sea-horse), skipper Francois Thysz or Thyssen—having on board Pieter Nuyts, afterwards ambassador to the court of Japan, and subsequently governor of Formosa—sighted the south coast near Cape Leeuwin, and made a close examination of the coast-line for 1000 miles, as far as Nuyts Reef and cluster of islets. The skipper's Christian name and that of Nuyts were given to two of the largest islands of the group, 'I. St. Pieter' and 'I. St. Francoys,' and the whole coast was named Nuytsland. This and the next discovery were 'accidental,' say the Tasman Instructions. In 1628 the *Vyanen*, homeward-bound from India, came upon the NW. coast in 21° (about the Kimberley district), and coasted along about 50 leagues without gaining any particular knowledge, 'only observing a foul and barren shore, green fields and very wild black barbarous inhabitants;' on board was a man—possibly the commander—named Gerrit Frederikszoon De Witt, which accounts for the 'G. F. De Wittland' found on Dutch charts.

In 1628 an expedition of 11 vessels was equipped in Holland for the East Indies; three of them sailed on 28 October before the others, under the command of Commodore Francis Pelsart. The *Batavia*, Pelsart's ship, was driven out of her course during a severe storm, and separated from the other two; she lost her reckoning, and on the night of 4 June 1629 struck on one of the islands of Houtman's Abrolhos, becoming a total wreck. The story of what followed will be found under PELSART; the only practical result was to confirm more strongly the Dutchmen's impression that the western coast of Australia was 'barren and accursed' and its inhabitants obnoxious and unfriendly. Pelsart in his journal mentions a Jacob Remessens River about 22° 17′ S., where none exists; this may, of course, have been a vague memory of the Willems or Ashburton.

The next Dutch discoveries were of minor importance. Gerrit Thomasz Pool with the yachts *Amsterdam* and *Wesel* was sent out from Banda in 1636 to make a detailed exploration of the Gulf of Carpentaria—which, it was still surmised, might yet be found to be the northern end of a passage running clear through the South Land into the southern seas. Pool coasted along New Guinea to 5° S. lat., made a landing there, and with three of his crew was murdered by the natives. The supercargo, Pieter Pieterszoon, took charge and continued the voyage; but adverse winds drove the ships due south on to the coast of Arnhem's Land, and after a long and fruitless voyage they returned to Banda.

Tasman's First Voyage.—In August 1642 Anthony Van Diemen, then governor-general of the Dutch East Indies, and his council availed themselves of the noted ability of Abel Janz (or Janszoon) Tasman to order a more extensive exploration of the South Land than had hitherto been attempted. Their main intention was to find out the extent of the continent, and to ascertain whether a passage north or south of it led into the South Sea. The *Heemskerck* and the *Zeehaen* were equipped for the voyage. Tasman commanded the expedition; the pilot-major was Franchoys Jacobszoon Visscher, and the skippers Ide Tjerksen and Gerrit Janszoon.

In October they left Mauritius and, steering SE., reached the latitude of 49° 4′ S. They then steered E. by N., with the intention of gradually working northwards to the Solomon Islands. On 24 November they made a landfall, apparently a little north of Cape Sorell in Tasmania, where the wind drove them off the land; rounding South-west Cape, they got a wind from the north and sailed along the south coast. Tasman named the outlying islands (and some peaks on the precipitous coast which he mistook for islands) after members of the council of India—De Witt, Sweers, Maatsuyker; to the basaltic rock off South Cape, whose black surface was covered with guano, he gave the name Pedra Branca, after a similar rock on the coast of China that the Portuguese had named long before; then sighting Borcel's Eylanden (the Friars), he turned north to Storm Bay, out of which a violent north-west gale drove him far to sea. On 1 December he rounded Cape Pillar (he called it De Zuyd Kap, and the neighbouring island Tasman's Eylandt—note that the varied spellings are taken from his chart), and came to anchor in North Bay near Green Island; next day Visscher was sent to explore Frederick Hendricx (Blackman's) Bay, and on the 3rd Tasman took formal possession of the country for Holland. On 4 December he started again, intending to sail northwards along the coast and discover a good watering-place; but the still prevailing north-wester kept him well offshore, and in despair—or from a constitutional dislike to venturing ashore in strange countries—he decided to stand away eastwards. After naming Marias Eylandt, Schoutens Eylandt and Vanderlins Eylandt—the last after one of the members of the council of seventeen (but it was really Freycinet Peninsula, which he mistook for an island)—he took his departure from 'a high round mountain,' St. Patrick's Head or St. Paul's Dome. Steering due east, after nine days he sighted land again on 13 December (this was the west coast of the South Island of New Zealand, south of Cook's Strait) and gave it the name of Statenlandt 'in honour of their High Mightinesses the States General.' Coasting northwards, he entered Golden Bay, where he anchored. Here the natives in their war canoes attacked one of the *Zeehaen's* boats, killed three of the crew, and mortally wounded

a fourth. Tasman accordingly named it Moordenaars (Murderers') Bay. The ships then sailed north along the west coast, and sighted and named, on the eve of the Epiphany, T'Eylandt Drie Coninghen (Three Kings Island) and Cabo Marya Van Diemens, after the wife of the governor-general; but no landing was made in New Zealand, partly owing to bad weather and the hostility of the natives, partly because (as has been hinted already) Tasman was a notorious coward. As Van Diemen wrote about his second voyage, a 'more vigilant and courageous person' might have done great things. After rounding the north of Statenlandt they steered north-east, and on 21 January came to several islands, to which they gave the names of Amsterdam, Middleburg, and Rotterdam—now known as Tongatabu, Eua, and Anamuka, part of the Tonga or Friendly group. Tasman, who was hospitably received by the natives, weighed anchor on 1 February, discovered a few more islands, steered N. by W. to 5° or 6° S. and then W. to New Guinea, sailed along the north coast of that island, and reached Batavia on 15 June 1643 after an absence of ten months.

Tasman's Second Voyage.—During his first voyage Tasman had not even sighted the continent, nor had he brought back news of the discovery of gold or silver or rich trade for the Company, as Van Diemen had hoped; but he had circumnavigated the Great South Land, and demonstrated that it did not reach to the south pole. Shortly afterwards another expedition was equipped to make an examination of the South Land itself. On 13 January 1644, by resolution of the governor-general in council, the ships *Limmen* and *Zeemeeuw*, with the tender *Bracq*, were commissioned for the voyage. They carried a complement of 111 hands, and were provisioned for eight months. Of this voyage nothing is known except its track as shown by a line on a chart; but Van Diemen's instructions to Tasman are distinctly interesting. He was still hopeful of the discovery of gold and silver mines, but had another goal also—the opening up of trade with Chile, coupled with possible raids on the Spanish settlements in Peru—the attainment of which depended mainly on the discovery of a passage eastwards between Australia and New Guinea. The instructions were therefore particularly full and detailed. After a long preface, in which previous voyages between 1606 and 1636 were enumerated and briefly described, Tasman was ordered to leave Banda on the last day of February, coast New Guinea to the Drooge Bocht, and spend two or three days there looking for a passage to the Pacific. If none could be found, he must follow the *Pera's* track southwards in the hope of finding a passage that way to the just-discovered Van Diemen's Land. If that hope too proved false, he must follow the coast westwards to Eendracht Land. Van Diemen at that time thought that Arnhem Land was an island, behind which a short cut to Willems River could be found.

Of the actual voyage, as has been said, only a track-line on a chart survives, for Van Diemen's summary of it merely states the results. It is clear, however, that Tasman landed nowhere; 'he who makes it his business to find out what the land produces' writes Van Diemen indignantly, 'must walk over it, which these discoverers pretend to have been out of their power.' As for the Drooge Bocht, he made no attempt to enter it; his track slides across its western end. Moreover, he seems to have been proud of this lack of achievement; his own chart lays stress on the fact that New Guinea and the South Land 'form all one continent together,' and reference has already been made to the inscription on his pilot's map. Tasman had roughed out the coast-line from Cape York to the Ashburton, and that was all. Van Diemen was slightly discouraged, but proposed to go on. The authorities in Holland, however, had had enough. Exploration cost money; gold-mines were not all profit; the best Dutch gold-mine was the Indian trade. In 1645 Van Diemen died, and Dutch exploration in Australian waters came to an end. There were wrecks occasionally, and accidental discoveries; but, except for a stray attempt in 1705 to penetrate the continent past Melville Island—which led to nothing but a pious belief that 'the South land in a great measure consists of islands'—Holland abandoned the barren and unfriendly regions south of the equator, and confined herself to exploiting thoroughly the rich archipelagoes of the north. It must be noted, however, that even Tasman's definite statement did not convince all Dutchmen that New Guinea and New Holland were a single mass of land; in 1685 or later Georg Eberhard Rumpf, governor of Amboina, mentioning the Drooge Bocht, added 'where, it is surmised, New Guinea is cut off from the rest of the Southland.'

One more Dutch voyage deserves notice, not so much on account of its results as because of one incident in it. On 29 December 1696 Willem de Vlamingh in the *Geelvinck*, looking for a supposed wreck, anchored near the mouth of the Swan River off an island mainly populated by rats as big as cats—wherefore he named the island Rottenest (Rats' Nest)—and rowed about 30 miles up the Swan, scaring blackfellows and birds in his progress. Thence he coasted the continent northwards to Dirk Hartog's Island; and on it they found the plate Dirck Hartog had left there in 1616. Vlamingh took it to Batavia, and it is now in the States Museum at Amsterdam; but he replaced it with a fresh plate, on which the old inscription was recorded together with one of his own. [In August 1801 the French captain Hamelin discovered this plate and remounted it on a pole; but in 1817 another Frenchman, Freycinet, took it to Paris and sent it to the Institut de France, where it has since been lost.] Vlamingh continued his coasting until he reached the Ashburton, and thence made straight for Batavia.

Dampier.—A little before Vlamingh's voyage, and just 100 years before the arrival of Phillip, the first Englishman sighted Australia. William Dampier (q.v.), buccaneer and naturalist, is one of the most interesting Englishmen of his time; but for the purpose of this article he is merely an observer of a land hitherto unknown to his countrymen. The *Cygnet*, in which he was at the moment a common sailor, on 4 January 1688 made her landfall near Cape Borda on the north-western coast, and worked round Cape Lévêque into King Sound, where the bay in which she anchored still bears her name. For nine weeks she lay there, while her crew explored the land and canoed about Buccaneer Archipelago, and Dampier studied the aborigines: his description of them as 'the miserablest people in the world—the Hodmadods of Monomatapa, though a nasty people, yet for wealth are gentlemen to these' has long been a classic, and his unsuccessful attempt to bribe them into working with the gift of an old pair of breeches and a jacket 'that was scarce worth owning' is characteristic no less of him than of them. On 12 March the

Cygnet sailed again. But, for all his avowed contempt, Dampier felt that Australia had possibilities; and at the beginning of 1699, after three years of adventure and six of obscurity, he persuaded the British admiralty to give him command of H.M.S. *Roebuck*, with 20 months' provisions aboard her, and commission him to explore the still half-mythical New Holland. His first intention was to round Cape Horn and make for the continent's eastern side, but dislike for cold climates spoilt this excellent design; he left England on 14 January, rounded Africa, and on 2 August sighted the Australian coast near Gantheaume Bay, where to this day the actual shoreline is unsurveyed and uncertain. Running northwards he entered and named Shark's (now Shark) Bay; finding no water-supply there, he resumed his coasting until he reached the group of islets now known as Dampier's Archipelago, where the tides puzzled him a good deal. Here he began to lose confidence in Tasman's chart, which he had been using as a guide; Tasman marked a continuous coast-line, and Dampier conjectured that he had stood farther off the land than he pretended, and had merely guessed at the position of the shore. He made one more attempt at landing, this time in Roebuck Bay, where he found poor water and the same miserable natives; disgusted with the whole country, he allowed the excuse of endless shoals to push him farther offshore, and in the end made for Timor, intending to reach the eastern coast of Australia north-about. From Timor he sailed along the northern coast of New Guinea and circumnavigated (and named) New Britain. His original intention of working thence down the eastern side of Australia was abandoned, mainly because he was too tired of that country to undertake fresh explorations in a rotten vessel with a half-mutinous crew; back to Timor he went, and to Ascension (where the ship foundered), and so to England. And with his departure the South Land had rest for nearly 70 years. The Dutch, growing weaker every year, found it necessary to concentrate on their known possessions in Malaysia. The English and French, though occasionally a philosophic author would contemplate schemes of Pacific colonization, were occupied with struggles for the nearer and more profitable regions of North America and India. A few voyagers traversed the Pacific westwards. Roggeveen the Dutchman (1721) struck the Samoan group; Byron the Englishman (1764-6) skirted the Society Islands and hit the Ladrones, Wallis (1766-8) practically repeated this voyage, and a third Englishman, Carteret, (1766-9) paralleled it to the south and made New Britain; Bougainville the Frenchman (1766-9) visited Tahiti, Samoa, and New Hebrides, and Orangerie Bay in New Guinea, but was scared by the breakers on the Great Barrier Reef and passed New Guinea north-about. Sooner or later the real discovery was imminent; but it was left to James Cook.

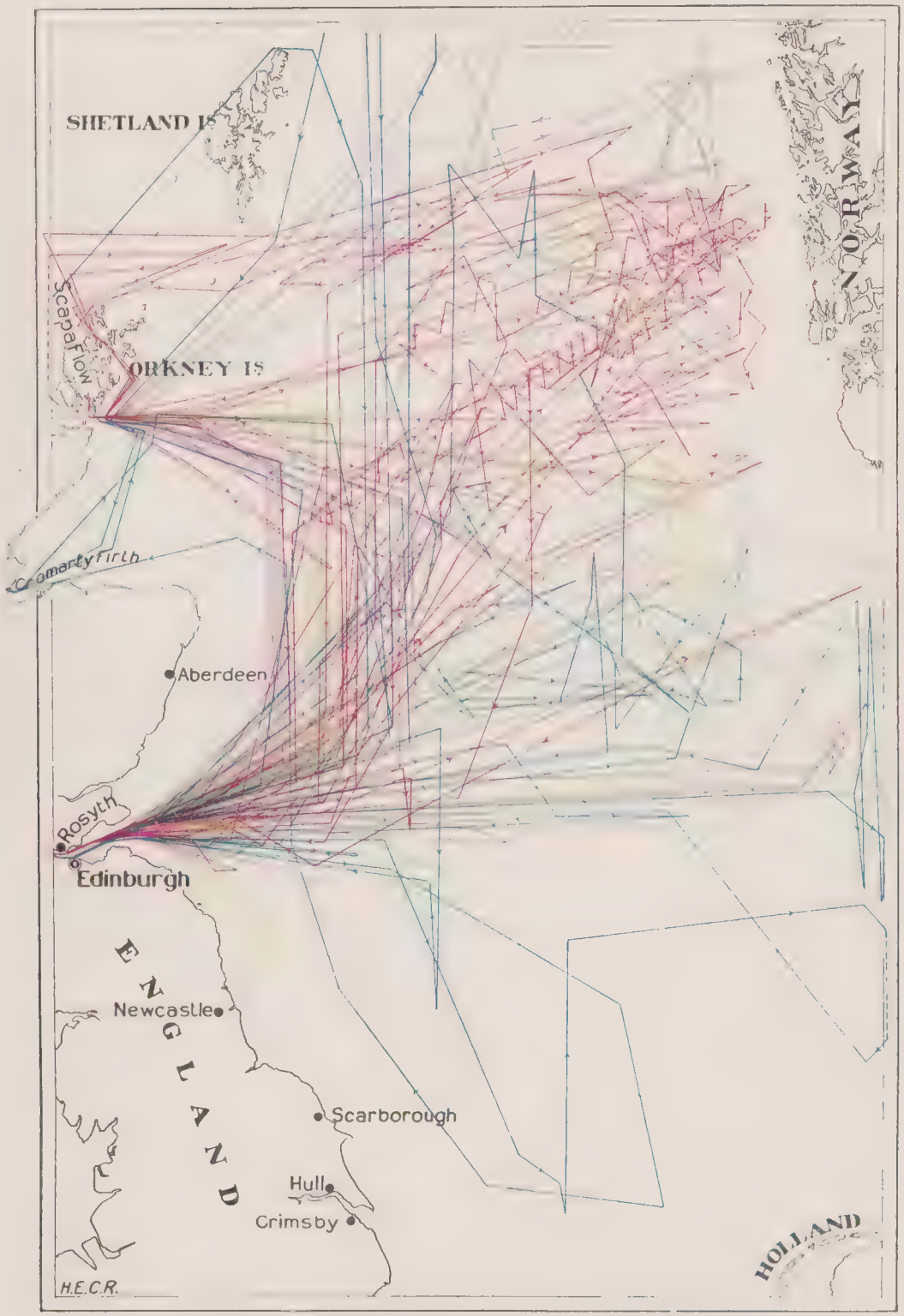
For the Spanish period the *Voyages* of Mendana, Galvano, de Morga, and Quiros, all published by the Hakluyt Society, are worth study: Markham's introduction to the Quiros volume is especially valuable. On the Dutch period J. E. Heeres's *Part Borne by the Dutch in the Discovery of Australia* and R. P. Meyjes's *De Reizen van Abel Janszoon Tasman en Franchoys Jacobszoon Visscher* are of primary importance; Walker's *Early Tasmania* and the *Voyage of Jacob Lemaire* (Hakluyt Society) should also be consulted. For Dampier, his own *New Voyage Round the World* and *Voyage to New Holland* (1729) are the only safe guides; of recent editions Masefield's (1906) is the best. On the whole period of discovery consult de Brosses's *Histoire des Navigations aux Terres Australes* (1756), Callander's *Terra Australis Cognita* (1766-8), Dalrymple's *Historical Collection of the Several Voyages and Discoveries in the South Pacific Ocean* (1770), Major's *Early Voyages to Terra Australis* (1859), and G. A. Wood's recent and excellent *Discovery of Australia* (1923). Collingridge's *Discovery of Australia* (1895) contains much useful matter, but is encumbered with improbable hypotheses.

Australia, Geography of. See GEOGRAPHY, ECONOMIC.

Australia, H.M.A.S., the first and (so far) only battleship of the Australian navy, was launched at Clydebank on 25 October 1911, commissioned in June 1913, and arrived in Australian waters in the following September. The motives and influences which caused and conditioned her building are narrated under NAVAL DEFENCE. She was intended to be one of three (or possibly four) battle-cruisers that would constitute the British battle-squadron in the Pacific, two others being maintained by Britain as flagships of the East Indies and China squadrons, and the fourth possibly in the future by Canada as flagship of a Canadian Pacific squadron. But the exigencies of European politics made it impossible for the admiralty to spare any more capital ships for Pacific waters, and when the European war broke out in August 1914 the *Australia* was the only vessel of 'Dreadnought' type flying the white ensign east of Suez.

She was a battle-cruiser of *Indefatigable* type, 19,200 tons, speed 26 knots, 44,000 horse-power; her armament consisted of eight 12-inch guns, 16 4-inch guns, and three submerged torpedo-tubes; her armour was ten inches thick on the turrets, eight inches amidships, and from three to six inches elsewhere. Excepting the Japanese, no other nation had in the Pacific any vessel to match her. Consequently, when war became imminent in July, and Admiral von Spee, the commander of the German Pacific squadron, had to decide on his first hostile acts, he put aside at once the thought of any raid in Australian waters. His two best ships, the *Scharnhorst* and the *Gneisenau*, were armoured cruisers of 11,000 tons each, armed with eight 8-inch guns, and capable of 23½ knots at best; although they could have given the big ship a great deal of trouble if attacked by her, it was obviously a futile proceeding to run them into unnecessary danger. It was for this reason (as we know from his own letters, afterwards published in Germany) that von Spee decided to leave the western Pacific altogether and make for South American waters: and thus the *Australia* by her mere presence secured the Commonwealth from raids of a most destructive kind which von Spee would certainly have made if he had had to meet light cruisers only.

Her doings during the war are narrated under NAVAL DEFENCE; but it may be repeated here that, after a period of convoy and patrol work in the Pacific (the admiralty refused—until after Coronel—Admiral Patey's repeated requests to be allowed to use her to chase the German squadron), she was taken to the North Sea and made flagship of the Second Battle-cruiser Squadron there. An unfortunate collision with her sister-ship the *New Zealand* prevented her from taking part in the battle of Jutland, but she soon resumed her station at the head of her squadron and kept it till the end of the war. What this meant in actual work at sea may be judged from the fact that, out of the 95,000 miles she covered during the war, almost 57,000 were steamed in the North Sea. In the spring of 1918 she was



NORTH SEA TRACK-CHART of H.M.A.S. *Australia*. 1915-18.
(Total distance steamed, 56,908 miles.)
1915, Blue. 1916, Green. 1917, Violet. 1918, Red.

used for experiments with seaplanes launched from a very short deck superimposed on one of her turrets. On 21 November of that year—the day of the surrender of the German High Seas fleet—she led the larboard line of battle accompanying the surrendered vessels into the Firth of Forth, and was afterwards charged with the surveillance of the battleship *Hindenburg*. On 15 April 1919 she left Portsmouth in company with the light cruiser *Brisbane* to return to Australia, and reached Port Jackson on 15 June. There being no immediate danger of naval war, and severe retrenchment being necessary to balance the Commonwealth budget, the battle-cruiser was soon placed in reserve. Under the Washington disarmament treaties of 1922, which limited the number of capital ships to be maintained by each of the Great Powers, the Commonwealth was compelled to 'scrap' the *Australia*, which was from the international point of view a British ship and from the British point of view obsolescent. After much discussion, during which it was proposed (*a*) to sink her off some port as the basis of a breakwater, (*b*) to turn her into a training-ship for naval trainees, (*c*) to send her to England to be sold as scrap-iron, it was decided to sink her with naval honours off the mouth of Port Jackson. All useful material having been removed, and much of her superstructure and fittings converted into mementos, the hulk—still equipped with her 12-inch guns—was on 12 April 1924 towed to sea, escorted by the *Melbourne, Adelaide, Brisbane, Anzac,* and *Stalwart,* and saluted as she went by the light cruisers of a British Special Service Squadron which, under Sir Frederick Field, was visiting Sydney during its tour of the world. Then, 24 miles due east of Port Jackson heads, the *Australia* was sunk in 150 fathoms.

Australia, Naming of. The use of some derivative of the Latin word *australis* for regions south of the equator is as natural and as little significant as the use of 'oriental' and its allies for regions east of Europe. That any land discovered in the southern hemisphere—outside Africa and South America, which already had names of their own—should be called (and mapped as) *Terra Australis,* or even (as de Brosses in 1756 called it) Australasia, needs little note and no explanation. But the specific names 'Australia' and 'New Holland' do need some explanation, and are dealt with here.

The earliest deliberate use of the word Australia is in an index to the Dutch *General Description of the Indies,* published in 1638. In the body of this book the word does not occur, nor does any allusion to the continent now so called; but a voyage made by Le Maire and Schouten in 1615-7 round South America via the Solomons and northern New Guinea to Java is called 'Australische Navigatien,' and the indexer refers to some passages in the account of this voyage as 'Australia Incognita Ontdeckt' (i.e. 'Unknown Australia Discovered'). Here, however, the word merely means 'southern lands,' and has no reference to our continent. Curiously enough a certain John Dunton, translator of de Foigny's *La Terre Australe Connue*—the scene of which is laid in or near South America—managed in 1693 to hit on the same word, rendering 'Terre Australe' by 'Australia;' and in 1770-1 Dalrymple used the name to designate an area east of South America. So the word existed long before it was applied as it is at present.

It so happens, however, that as a misprint 'Australia' had occurred even before 1638. In 1606 de Quiros discovered the New Hebrides and, believing that the island on which he landed was part of a great continent, named it 'Austrialia del Espiritu Santo' in honour of his king (Philip III of Spain, who was an Austrian prince); he intended this name to apply to the whole supposed antarctic continent—'all the region of the south as far as the Pole,' 'the fourth part of the world, Austrialia incognita.' But the cumbrous name was too much for most of his translators, English, Dutch or Latin; for instance, an English translation of one of his memorials to King Philip, published in *Purchas His Pilgrimes* in 1625, transliterates the name sometimes as 'Austrialia,' sometimes as 'Australia'—clear evidence that the mistake was due to accident, not to design. Later writers, however, including Hawkesworth, adopted and repeated the wrong spelling.

The genuine mainland of the present Australia, when first discovered by the Dutch (earlier discoveries—for which see AUSTRALIA, DISCOVERY OF—are still in the hypothetical stage), was at first vaguely known as *Terra Australis.* Tasman's chart of 1644 shows it as 'Compagnis Nieu Nederland,' but within ten years or so the name *Nova Hollandia* was definitely attached to it, and—translated into English and other languages as required—was for almost 200 years its official designation. It is interesting to note that in 1650 and thereabouts another New Holland was at any rate locally recognized; Martin Martini, a Jesuit missionary to China, writes of 'the island Formosa, and new Holland,' and again of 'an Island called new Holland,' as Dutch settlements off the coast of China—this was probably one of the Lu-chu group. As applied to Australia, however, the name denoted only the area W. of (roughly speaking) 135° E. long.; E. of that line, men thought for many years afterwards, there were islands, possibly, but no great extent of mainland, and the vague name was still good enough for them. Then came Cook, who assumed that his discoveries lay on 'the eastern coast of New Holland;' but this did not preclude the possible division of New Holland into two large islands by a sea-passage through the middle, such as had been used by Swift for the location of his Lilliput. When, therefore, Phillip was sent to found a settlement in the regions annexed by Cook, the western boundary of his jurisdiction was fixed by the British authorities at that degree of longitude—135° E.——which, as we have seen, was the Dutch limitation of the area along which their coastal discoveries had been made; and the custom grew up of calling all land W. of that degree 'New Holland' and all E. of it 'New South Wales.' This custom was not, however, universal. French writers of the eighteenth century frequently used the adjective '*Australien*' and occasionally the noun '*Australie*' in connection with an unknown but possible southern continent; and in 1788 a French writer of light fiction and gossip, Nicolas Edmé Restif (usually known as Rétif de la Bretonne), in a visionary account of affairs a hundred years ahead wrote of 'New Holland, which under the name of Australia is becoming a powerful empire.' This is the first known instance of the use of the word to denote the continent itself, not imaginary or then undiscovered lands. Again in 1793 a *Zoology and Botany of New Holland,* published in London, referred to 'the

vast Island or rather Continent of Australia. Australasia or New Holland.'

The man who settled the matter once for all was Matthew Flinders. As early as 1804 he was using 'Australia' for the whole continent, comprising New Holland and New South Wales; and thence onwards he fought steadily for its adoption. Joseph Banks, for reasons unknown, disliked it, and Flinders was forced to retain *Terra Australis* in the title and text of his book, though he slipped in a modest footnote advocating his real preference. But Banks was not the only autocrat in Australian affairs; he met his match in Lachlan Macquarie, who adopted the Flinders suggestion as soon as he came across it, and from 1817 onwards persistently called the continent Australia, and officially recommended the name as a substitute for 'New Holland.' The colonial office, of course, was conservative, and retained the old name for many years; in 1826 both Western Port and Shark Bay were considered to lie on the coast of New Holland (though in 'Australian Seas'), and Darling conformed to superior authority—though in 1827 he suggested the use of an official button stamped with the word *Australia* for officials of the New South Wales government. As late as 1849 the mainland was still known as New Holland by British officials, though they had by that time adopted 'Australia' to designate the Australian settlements as a whole—i.e. New Holland plus Van Diemen's Land. But long before that—roughly speaking, from the middle of the twenties—Englishmen outside official circles had followed Flinders and Macquarie, and knew 'Australia' for what it means to-day.

See Scott's *Life of Captain Matthew Flinders*, ch. xxx, and *Historical Records of Australia*, ser. I, vol. ix, pp. 867-9.

Australian. This adjective, followed by the name of some European plant, makes names for many Australian plants that are supposed to resemble in one way or another their European namesakes. Among them are Australian Celery, for which see APIUM; A. Edelweiss, see COMPOSITAE; A. Heath, see EPACRIS; A. Lilac, see PROSTANTHERA; and A. Shamrock, see TRIGONELLA.

Australian Agricultural Company. Among the numerous recommendations of Commissioner J. T. Bigge (q.v.) was one, based on the work done and the results obtained by John Macarthur, that 'settlers possessing capital and a real intention of pursuing the same beneficial course of industry' should receive grants of land in New South Wales 'in proportion to the number of convicts they engaged to employ and to the numbers of sheep and cattle they took with them.' Attracted by this suggestion, John Macarthur junr. and 11 English capitalists (including three members of parliament) in April 1824 formed in London a company with £1,000,000 capital to take up a million acres 'for the purpose of raising fine wool and, subordinate to that object, cultivating the vine, olive, flax, and other productions now imported from the shores of the Mediterranean.' It was further proposed to make special attempts to improve the morals of assigned convicts: to introduce German, French, and Swiss labour for the expert treatment of the wool, etc.: and to pay particular attention to female emigration. Lord Bathurst, then colonial secretary, took great care to ensure the public advantage—he approved, for instance, of olive-growing, but suggested that vineyards on a large scale might interfere with the wine export trade of the Cape Colony: and on 21 June 1824 the company was approved by act of parliament.

The directors at once appointed a local committee of advice, consisting of John Macarthur's nephew Hannibal, son James, and son-in-law James Bowman, Archdeacon Scott (who refused to act and was replaced by Saxe Bannister) and P. P. King: this committee seems to have done nothing except talk to the surveyor-general, John Oxley, who recommended (*a*) Liverpool Plains, (*b*) Port Stephens, as a site for the settlement. As agent and manager the directors appointed Robert Dawson, who on 26 June 1825 sailed from England in charge of 80 settlers, 720 sheep, 15 thoroughbred horses, and 12 head of cattle. A five months' voyage brought them to Sydney: on 1 January 1826 Dawson, with a party that included Henry Dangar (at that time assistant surveyor under government), proceeded to Port Stephens, and by May 1826 the settlers and stock were on the land. Jesse Gregson, the historian of the company, points out how hasty and superficial were the measures taken to secure suitable land, laying the blame partially on Dawson but mainly on the local committee. Within a year the obvious results followed: distracted between the proposals of the English directors (who wanted to add silk, tobacco, sugar, and cotton to the already long list of desired products), the competition with private settlers for assigned servants (which was rapidly earning the company great unpopularity), and the difficulty of growing fine wool either on the coarse coastal pasturage or in the rough country inland, Dawson let the settlement run to seed and was in the end suspended by the local committee. John Macarthur himself, taking charge for a time, came to the conclusion that success was impossible, and the enterprise was on the brink of failure. At that moment the British government—which had benefited considerably by the company's absorption of convicts—offered to hand over to it the coal-mines at Newcastle, which under government control had never been a success. Both the local committee and Governor Darling raised strong objections; but the authorities in England, at both the colonial and the company's office, persisted, and in June 1830 the company received a grant of 2000 acres of the Newcastle coal-field, with a practical monopoly of coal-mining in New South Wales for 31 years. (The British law authorities denied that it was a monopoly, but the result was the same.) Already in 1829 the directors had cancelled the appointment of the local committee and made Sir W. E. Parry (q.v.) sole manager ('commissioner') of the company's Australian properties. He reached Sydney at the end of the year, and at once inspected and condemned the greater part of the Port Stephens grant: the English directors obtained from their government an order directing the governor of New South Wales to allot them about half a million acres somewhere in the interior, the company surrendering an equivalent area at Port Stephens: and Henry Dangar—who had left the government service and joined the company's—discovered for them two fine blocks of land on or near the Liverpool Plains. This land was outside the region where settlement could legally be established, but a few cattle- and sheep-owners were 'squatting' there (among them John Blaxland and William Dangar); and Bourke in 1832 refused to let the company take the desired areas, as he held that the men actually living there should have first choice if the land was to be thrown open at all.

The directors, however, appealed to the British government and had Bourke's decision reversed: and the poorer part of the land at Port Stephens —which had been selected by the company's own officials, not thrust on them by the government —was exchanged for the two fine stations (about 600,000 acres in all) afterwards known as Warrah and Goonoo Goonoo, the one behind Quirindi, the other facing Tamworth across the Peel River. Parry also finalized the Newcastle transaction, and in 1831 was selling coal to the public.

From this time onwards the company prospered. Parry, retiring in 1834, was succeeded by Henry Dumaresq, and he, dying in 1838, by P. P. King —in whose time James Brown, by opening a coal-mine near Maitland, challenged the company's monopoly and, though the legal decision went against him, procured the abandonment of the company's privilege. At the same time the then colonial secretary, Earl Grey, gave the company its title-deeds to the whole of the properties it was in possession of. At the end of 1849, for financial reasons, the office of commissioner was abolished, and A. W. Blane, one of the board of directors, who was sent to reorganize the Australian establishments recommended that the Goonoo Goonoo station should be sold. Unwilling to let so valuable an estate (on which gold had just been discovered) pass into other hands, the directors merely formed a new company—the Peel River Land and Mineral Company—composed almost entirely of shareholders of the old company, which took over Goonoo Goonoo and put it under the management of P. G. King, while Warrah, the Port Stephens grant, and the Newcastle mines remained in the hands of the Australian Agricultural Company, with M. F. Brownrigg as manager. The result of these operations was, to quote the directors' report, that 'the original capital of the Australian Agricultural Company will virtually be paid back to the proprietors, with an addition of £15 per share, while the Company will retain two valuable estates of more than 700,000 acres, the north shore of the harbour of Port Stephens, its extensive property at Newcastle, and a coal-field of 2000 acres, together with a contiguous property of 2000 acres more.'

The company's history has thus far been treated in some detail, because it exemplifies well the methods by which, when the colonial office could override the decisions of colonial governments, the land problems of young colonies were often crudely solved. From 1853 onwards the two companies became merely business organizations operating under the ordinary laws of the colony, and as such need little further discussion. The Peel River Company remained essentially a pastoral business, until its land was resumed in blocks by the State government for purposes of closer settlement (1908-20): the Australian Agricultural Company, on the other hand, while retaining its stations, became in the public eye more and more associated with coal-mining, especially after its Gloucester (Port Stephens) estates were resumed by the State government in 1903. Large hematite deposits were discovered near Pumpkin Point in 1856, but were not exploited until 1874, when the ore was found too intractable for profitable use. In 1908 the company began to split up its lands at Warrah, selling a large block for closer settlement; the State government resumed 45,000 acres of the same estate in 1912, and the company in 1915 and 1922 sold other blocks—so that the Warrah estate, originally comprising about 250,000 acres, was at the end of 1922 reduced to about 113,000. The company's principal coal-mine (the 'Sea Pit' colliery) being exhausted in 1914, it abandoned that branch of enterprise, selling its other colliery (at Maitland) to a Victorian company.

See Gregson's *The Australian Agricultural Company, 1824-1875*, a valuable and authoritative history by a former manager of the company.

Australian Imperial Force, THE. (For convenience' sake this narrative deals not only with the A.I.F. proper—i.e. the military divisions which fought in Europe and Palestine —but also with the small expeditionary force which was sent to New Guinea soon after the outbreak of war, and the volunteer detachments which served in Mesopotamia, the Caucasus, and European Russia.)

During the world-war of 1914-18 Australians fought in three continents and became known to the people of almost every nation. They fought in the snows. They fought in the tropics. They fought in every element—air, land, sea, and under the sea. The records of the land and air forces only show that, first and last, the total number of troops raised in Australia for the war was 416,809, of whom 330,000 were sent overseas; the total casualties in all theatres of war were 226,073. The percentage of casualties to the total numbers engaged was greater for Australia than for any other part of the Empire, as the above official table, furnished by the British war office, shows.

Country	Troops raised	Troops sent overseas	Total casualties	Killed, died and missing	Percentage cas. to numbers engaged
United Kingdom	5,704,416	5,000,000	2,626,743	1,010,001	52½
Canada	628,964	411,834	210,151	60,425	51
Australia	416,809	330,000	226,073	59,258	68½
New Zealand	105,629	99,822	57,887	16,483	58
South Africa	228,907	* 228,907	18,718	7,274	8¼
Newfoundland	11,922	11,922	3,509	1,195	30
India	1,401,350	953,374	104,684	43,695	11

*Includes 92,837 coloured troops used for labour and transport. South Africa was a theatre of war.

The N. and M.E.F.—At the outbreak of war in August 1914 Australia's most immediate anxiety was to discover the whereabouts of the German Pacific squadron, whose ships had not been located since mid-June: as their nearest base for an attack on Australia was at Simpsonshaven in New Britain, the Australian squadron was sent there to look for them. On 7 August the federal government received from London an official message suggesting that the seizure of the German wireless stations at Rabaul, Yap and Nauru would be 'a great and urgent Imperial service.' Volunteers were at once called for, and on 19 August Colonel William Holmes left

Sydney in the troopship *Berrima* with about 1500 men—six companies of the naval reserve, a battalion of infantry, two machine-gun sections, and signalling and medical detachments. This force, after eleven days' training at Palm Island off the Queensland coast, reached Blanche Bay in New Britain on 11 September, escorted by H.M.A.S. *Australia* and three destroyers. At 6 a.m. on that day two parties of naval reservists (25 men in each) landed at Kabakaul and Herbertshohe (now Kokopo) with orders to discover and capture a wireless station that was known to exist somewhere inland. The Kabakaul party, after advancing about two miles, came under rifle fire from a small entrenched position across the Bitapaka road: reinforcements were quickly landed from the destroyers and the *Berrima*, and the enemy surrendered. The wireless station was captured that evening. Two Australian officers and three seamen were killed, and four seamen wounded—the first Australian casualties in the war. The Herbertshohe party penetrated five miles inland without opposition, and then returned to the coast. On the 12th Rabaul was occupied without opposition by the infantry, and next day the military occupation of the island was formally proclaimed. The German governor had retired to Toma, about ten miles inland, but a raid towards his headquarters on the 14th, aided by a few shells from the *Encounter*, brought him to terms, and on the 17th he signed a capitulation which, though it did not formally surrender any territory, guaranteed that throughout German New Guinea (a name involving all the German colonies in the Pacific except Samoa) no resistance should be offered to British occupation. On the 21st the enemy troops, German and native, laid down their arms, and on the 24th Friedrich Wilhelmshafen (Madang), the chief settlement on the New Guinea mainland, was occupied without resistance. The occupation of the outlying islands proceeded leisurely: Kaewieng in New Ireland was taken on 21 October, Nauru (whose wireless station had been destroyed by the *Melbourne* on 9 September) on 6 November, the Admiralty group on 21 November, and Bougainville and Buka on 9 December. During the next two months the greater part of the original expeditionary force was returned to Australia, leaving behind it a small administrative body to carry on the government of the colony, which was until the end of the war considered to be German territory under temporary military occupation.

Origin of the A.I.F.—On 3 August the Australian government cabled to Britain on offer (*a*) to place the Australian navy under the orders of the admiralty, and (*b*) to send 'an expeditionary force of 20,000 men of any suggested composition to any destination desired by the Home Government.' The offer was promptly accepted, and Australia set about creating the force which General Bridges even then spoke of as 'the 1st Australian Division.' Before many days had passed, its title, in order to avoid confusion with the expeditionary force sent to German New Guinea, became the Australian Imperial Force—subsequently immortalized as the A.I.F. In the event, the First Convoy carried rather more than one division of Australian troops, for there were four infantry and two light horse brigades (including one of each from New Zealand).

The transports left Albany (the port of concentration) on 1 November 1914, and landed in Egypt early in December. The destination of the Australian force had for long been matter for conjecture. The original intention was to send it through the Suez Canal to Europe; when a rebellion broke out in South Africa, a countermanding order (of 25 October) diverted the convoy to the Cape, but on 31st this was revoked, as Botha had defeated the rebels. The final destination of the troops was, however, again altered—and thereby, perhaps, the course of the war—by the intervention of Sir George Reid, the Australian high commissioner in England. The war office was preparing camps for all Dominion troops on Salisbury Plain, but not enough huts were ready, or procurable in time, for all the contingents expected; and Sir George Reid represented to Lord Kitchener in person the danger of bringing troops from a warm climate to the bleak Salisbury Plain in winter, with no shelter but tents. Kitchener, surprised that the war office contract for the erection of huts had not been completed, agreed with Reid, and suggested that the Australians should undergo their war-training in Egypt; the Australian government approved, and General Bridges, who was in command of the expeditionary force, received at Aden a wireless message informing him of the new plans. On 3 December disembarkation began at Alexandria.

In Egypt the first task was organization. When they arrived the troops met for the first time General Birdwood, whom Kitchener had appointed to command them, and his chief-of-staff Brigadier-general H. B. Walker, afterwards G.O.C. the 1st Australian division. As a second convoy with another Australian infantry brigade (the 4th), two more light horse brigades, and certain lines-of-communication troops (motor transport and hospitals), was due shortly, Birdwood decided to form an army corps of three divisions, two infantry and one mounted; the existing Australian division under Bridges, a 'New Zealand and Australian' division (the 4th Australian brigade, the New Zealand infantry brigade, and a third if it could be procured), and a mounted division of three Australian light horse brigades and the New Zealand mounted rifles. But some of these troops were still on their way; to avoid delay, therefore, one Australian and one N.Z. mounted brigade were incorporated in the 2nd division, the 3rd division remained imaginary, and the 2nd and 3rd Australian mounted brigades were kept as corps troops. The army corps was named 'Australian and New Zealand Army Corps,' and the clerks at Birdwood's headquarters coined from its initials (shown on a rubber stamp used for registering correspondence) the word 'Anzac,' which early in 1915 was adopted as the corps' code name, and eventually became famous.

In February 1915 some fighting on the Suez Canal ended in the repulse of a Turkish attack, made partly with the idea of encouraging internal trouble in Egypt; but no insurrection actually occurred until the end of 1915, and then only among the western desert tribes. The Australians and New Zealanders were first launched into the war in 1915 in the campaign for the Gallipoli peninsula—an attack aimed at the heart of the Turkish empire in order to crush the Germans' eastern ally, to open permanent and safe sea communication with Russia, and to swing Balkan opinion to the side of the Allies. The enterprise began in February as a naval demonstration against the Dardanelles forts—a mere threat to frighten Turkey and relieve Turkish pressure on the Russians in the Caucasus. While plans were being discussed for the naval bombardment, Winston Churchill (then first lord of the admir-

alty) urged co-operation by a Greek army to be landed on the peninsula; but the use of Greeks was vetoed by Russian jealousy, and the British war office protested that there were neither troops to spare nor transports to convey them. At intervals during February and March an Anglo-French fleet bombarded the forts at the entrance to the straits in the Narrows, and managed, indeed, to silence the nearer Turkish forts more than once; but naval landing parties were unable to proceed far beyond the beach at Helles, and the fleet lost several ships from enemy mines sent adrift down the channel. Only when the moment of surprise had passed and several weeks had been spent in fruitless attempts to prove that the navy by itself could force the straits, was it recognized that military co-operation was necessary. Then General Sir Ian Hamilton was sent out from England to take command of the army for the proposed landing, the troops allotted for it being the Australians and New Zealanders in Egypt, the royal naval division (also in Egypt), and the 29th division (sent out from England). There was also a French division under General d'Amade, some troops of which on the day of the landing made an attack on the Asiatic shore by way of creating a diversion. Hamilton assembled his troops at Lemnos, as his advanced base, and on the evening of 24 April the assaulting divisions were carried in transports and warships to the points selected for attack. The main blows were to be delivered by the 29th and royal naval divisions and the French division at five beaches near Cape Helles, and by the two Anzac divisions at a beach just north of Gaba Tepe. The southern attack aimed at seizing Achi Baba height and the Kilid Bahr Plateau, and the northern attack the eminence called Mal Tepe, the occupation of which would isolate the Kilid Bahr position. By way of diversion, part of the royal naval division was to make a feint at landing near the Bulair lines, at the extreme neck of the peninsula, and a French force was to land on the Asiatic shore.

Landing at Anzac.—The landings were most gallantly made at about dawn on 25 April; but in the two months which had elapsed since the first naval bombardment the Turks, well warned of what might follow, had vastly improved the military defences of the peninsula. The assault, which on 19 February might have overrun the desired plateau in a few hours, was parried on 25 April among the tangled foothills and valleys, despite heroic efforts on the part of the attacking troops to push through. After a whole day's desperate fighting the 29th division made good a landing at Helles, and the Anzacs at the beach afterwards called Anzac Cove; as a matter of fact, they landed nearly a mile farther north than had been intended—an error due to movement in the dark against a shore current, and to the anxiety of the boats to make the beach without delay or alarming hostile sentries. The troops selected to lead the assault, (Maclagan's 3rd Australian infantry brigade) dashed from the boats under a hot and increasing fire, having been discovered before the first keel grounded. Pell-mell into the bush of the lower slopes, and thence up to the steeper ridges and valleys, rushed little parties of the first four battalions, separated inevitably by the confusion of the landing and the natural obstacles they encountered. McCay's 2nd Australian brigade, arriving soon afterwards, had been intended to advance on the left of the 3rd and cover that flank; but Maclagan's urgent appeals for assistance made McCay direct his men to follow the 3rd brigade up the valleys, now resounding with the din of the Turks' artillery and machine-guns. MacLaurin's 1st brigade was pushed on, as it landed, in support of the 2nd, and the attack on the left flank fell to the share of the Anzac division, whose brigades stormed high ground afterwards known as Plugge's Plateau and Walker's Ridge. By the end of the day some sort of a line had been formed in a roughly circular position, its farthest points some 2000 yards east of the beach. It had become fixed there as the battalions, much mixed and weakened by losses, fell back from successive Turkish counter-attacks. Some few men of the 2nd and 3rd brigades penetrated that day as far at Battleship Hill and almost to Gun Ridge, nearly twice as far out as the ultimate rallying line. Throughout the night of the 25th and the following two days Turkish counter-attacks were almost continuous—so persistent, indeed, that for three days the Anzac line could not be sorted out into battalions again, or the men themselves allowed any rest.

The object of the landing had failed, and thenceforward for three months operations consisted mainly in improving the narrow positions won. An attack on 2 May (by New Zealanders and Australians) on the hill called Baby 700, leading to the ridge of Sari Bair, was unsuccessful, as was a smaller attack by a party of the 11th Australian battalion on Gaba Tepe peninsula, south of Anzac Beach. At Helles, too, repeated efforts were made to advance on Krithia heights; on 8 May the 2nd Australian brigade and the New Zealand infantry brigade co-operated at Helles with the royal naval division in one such limited advance against a murderous machine-gun fire. On 18 May—this force having fortunately been moved back to Anzac in time—came the strongest Turkish effort of the campaign to drive the Anzacs back into the sea. From 2.30 a.m. for seven and a half hours the Turks hurled themselves repeatedly against the whole Anzac front, especially at the centre; but at 11 a.m., when the attack began to die down, the Australian trenches were still intact, and some 3000 enemy dead strewed the ground in front of them. The casualties were so heavy that on 24 May an armistice was arranged for burying the dead. This defeat, followed by another on 29 June in a determined attack against the angle of the Australian line known as the Nek, established the tenacity in defence of the Dominion infantry and sharply cooled the enemy's ardour.

The Suvla Fighting.—Sir Ian Hamilton was convinced that he must have a considerably increased force before he could win the summits which commanded the straits, and has recorded his reasons for believing that, if the troops he requested had been sent to him, he could have won the campaign. In May he asked the war office for two army corps. Ultimately five more divisions were sent to him; but his strength on paper was gravely misleading, for (as he repeatedly pointed out) reinforcements were not furnished to make up the losses in all divisions. In these circumstances the weekly wastage in the line at both Helles and Anzac was alarming. Hamilton realized by July that he must make the best of what troops he had, and that to delay action while he reiterated his representations about the rifle strength of his divisions would make his position grow steadily worse. In short, he had to attack while his divisions were still strong enough to do so. He decided to land two extra divisions each at Helles and Anzac, to launch a

combined assault, and then to throw ashore the 11th division and two brigades of the 10th at Suvla Bay, 'to capture hill 305, and, working from that dominating point, to grip the waist of the peninsula.' The battle began at the end of the afternoon of 6 August. At Helles the 29th and 42nd divisions fought desperately to gain 'the Vineyard' in the centre of the Turkish position, and for seven days a violent struggle continued here, but without more than the slightest local success. Simultaneously with the beginning of this attack the 1st Australian brigade was flung into a ferocious assault on the Turkish position at Lone Pine. That engagement was perhaps the fiercest of the whole campaign. The enemy trenches were roofed over with logs, and the fighting in those vaulted ways when the Australians entered—tearing holes in the roof, or finding a way by some communication trench—was of the bloodiest description. Three trenches were taken in this fashion; then followed a second hand-to-hand conflict, a Turkish counter-attack. For three days counter-attacks continued, but Lone Pine was held. Meanwhile on 7 August the remainder of the 1st division and the dismounted light horse were badly mauled in another attack from a series of famous posts towards Mortar Ridge and Baby 700. The effort wilted under a concentrated fire, but was noteworthy for the gallantry with which successive waves of light horsemen charged forward, knowing they were going to certain death. Their attack was practically wiped out. The main attack on Sari Bair, also on 6 August, was delivered by a mixed force of about two divisions under General Godley, which advanced from Ocean Beach just north of Anzac. This attack was intended to link up with the planned surprise advance of British troops from Suvla Bay. The New Zealanders advanced successfully to a position under Chunuk Bair. To their left the 4th Australian brigade moved up one branch of the Aghyl Dere, and a Ghurka brigade up a second branch of that gully, till they joined the New Zealand flank on Rhododendron Spur. Here the troops dug in before strong forces of the enemy on the lower slopes of Sari Bair ridge. At dawn on 8 August, the expected support on the left flank from the Suvla Bay force not having appeared, the New Zealanders on the right again attacked towards Chunuk Bair and the 4th brigade towards Abdel Rahman ridge. Between these two columns Indian infantry and some British battalions fought forward towards Hill Q, north of Chunuk Bair, and some few of the attackers actually reached the summit of the central ridge. They were too few to hold on. The left of the attack was entirely in the air and was being enfiladed; the Suvla Bay force was still missing; but the objective was so nearly won on Godley's front that a further attack was ordered for dawn on 9 August. A British supporting column of five battalions under General Baldwin, marching up to deliver the decisive blow, lost its way and arrived late. Some of the South Lancashires and the Ghurkas actually reached the col between Hill Q and Chunuk Bair, whence for the first and last time they looked down on the straits; but the support of Baldwin was lacking, and they were speedily driven back by overwhelming numbers of Turks. Baldwin's attack came too late to succeed. The opportunity was lost; the 4th Australian brigade on the left was nearly surrounded and had to fight its way back; and on 10 August two British battalions (which had relieved the exhausted New Zealanders on the slopes of Chunuk Bair) were overwhelmed by about twelve times their number of Turks.

The most tragic failure was perhaps at Suvla, where General Stopford's force (the 11th division, plus two brigades of the 10th) was landed during the night of 6-7 August. The surprise of the landing was complete; there was practically no opposition at the beach or beyond it; but, instead of pushing on with every available man, the force wasted nearly twelve precious hours over assembling in the sand dunes. Patrols sent out had on 8 August reached a point five miles inland. Anafarta plateau could apparently have been occupied with ease, but was not, and no effort was made to support the flank of the attack on Chunuk Bair farther south. On the night of the 8th the Turks hurried troops to parry this unexpected landing, and when on the 9th Stopford's force advanced towards the high ground south of Tekke Tepe, they were driven back. The opportunity here—a far more favourable opportunity than at Hill Q, and one deliberately created—had also vanished.

Hamilton demanded a further effort before he finally gave up hope, and on 21 August the 11th division was ordered to attack across Anafarta Biyuk valley, while the 29th division attacked Scimitar Hill, and a mixed Anzac force moved on Hill 60 (on the flank of the 4th brigade's advance of the 8th). Hill 60 had in the interval been converted by the enemy into a strongly fortified position, and not till the 27th did a final attack establish the Australian line across the summit. In this fighting, which lasted continuously for a week, troops of the 2nd Australian division, newly come from Egypt, took part. At the end of August the 2nd division and the British 54th division took over the Anzac line from the original Anzac divisions, which were withdrawn to rest at Mudros. The battle for Hill 60 was the last fight of the campaign. An interval of inaction followed, attended by dysentery and other sickness, heavy rains, and the first of the winter gales. By October the war office was foreshadowing the evacuation of the peninsula.

The Evacuation.—This evacuation was probably the most skilful exploit in the Gallipoli operations. In October Hamilton, in reply to war office enquiries, estimated that withdrawal would involve the loss of 50 per cent of the force, but Monro, who took over the command, declared unhesitatingly for evacuation. Kitchener himself visited the peninsula in November, and on 8 December Monro ordered Birdwood to proceed with the evacuation of Suvla and Anzac. Between that date and the 20th it was carried out with exemplary skill. The enemy was completely deceived. A few guns were destroyed at the last, and considerable quantities of stores on the beaches were set on fire; but under the arrangements devised by Birdwood and his staff 80,000 men, 5000 horses, and 200 guns were withdrawn from this portion of the peninsula without any casualties, and without any suspicion on the part of the Turks. Three weeks later—on 8 January 1916—the troops at Helles were withdrawn with similar success and immunity from molestation. The total Gallipoli casualties (including French and naval) were 33,532 killed, 78,518 wounded, and 7689 missing. Of these the Australians had 8587 killed and 19,367 wounded.

Reorganization.—At the close of the year the Australians and New Zealanders were re-transported to Egypt. Some light horse and a company of the Australian camel corps took part,

along with mixed detachments of the Egyptian garrison, in the short December campaign against the Senussi, whose incursion into western Egypt had stirred up disaffected Bedouins. There was smart fighting in the desert west of Alexandria during December, January, and February, but by March the rising was crushed, and the Senussi abandoned their effort. The winter and the early spring were occupied in reorganizing the now greatly increased Australian army, preparatory to their expected removal to the western front in Europe. The 2nd Australian division and an extra infantry brigade (the 8th) had arrived from Australia, and a 3rd division was being raised in the Commonwealth. Available infantry reinforcements in Egypt made possible the creation on the spot of still further divisions. It was decided that each of the four original infantry brigades should throw off the nucleus of another brigade. Accordingly, working by battalions, the 1st brigade provided the seasoned nucleus of the (new) 14th brigade, the 2nd parented the 15th, the 3rd the 13th, and the 4th the 12th. This enumeration was dictated by reason of the fact that the numbers 9, 10 and 11 had been allotted to brigades of the 3rd division then being formed in Australia. All brigades were then raised to normal strength again by the addition of raw troops, reinforcements from Australia. Then the 4th, 12th, and 13th brigades were assembled into the 4th division under the command of Maclagan, and the odd 8th brigade was amalgamated with the 14th and 15th brigades into the 5th division, under McCay. Monash left the 4th brigade to take over command of the 3rd division when it arrived in England; Walker remained with the 1st division, and Legge with the 2nd. Birdwood was now given command of the 1st Anzac corps (1st, 2nd, and 4th Australian divisions), and General Godley of the 2nd Anzac corps (New Zealand division, 5th Australian division, and a British division later attached). Other reorganization plans created the Anzac mounted division (1st, 2nd, 3rd light horse brigades and New Zealand mounted brigade) under General Chauvel, and the Imperial camel corps. The latter began as a composite camel battalion, formed by two sections selected from each Australian infantry brigade; a second battalion was composed of English and Scottish territorials, a third (later) of Australians and New Zealanders, and at the end of 1916 a fourth of Australians. The camel corps was disbanded in May 1918, and two new light horse regiments formed from it were added to the Australian mounted division—which began as the 'Imperial' mounted division, and was formed early in 1917 by amalgamating the 5th (British) yeomanry brigade, the 4th A.L.H. brigade, and the 3rd A.L.H. brigade (from the Anzac mounted division). The name 'Australian mounted division' was given it about the middle of 1917. These two mounted divisions and the camel corps made up the desert mounted corps, renowned later in the Palestine campaign under General Chauvel. The artillery of the divisions was expanded in much the same fashion as were the infantry units. Later on in France, machine-gun battalions and trench-mortar batteries, when these were added to the infantry fighting power, were also built up, each from a trained nucleus.

Another arm of the A.I.F. which grew from a small detachment into a field unit, and threw off the material for other units as required, was the Australian flying corps. This service began with the half-flight which served in the first Mesopotamian campaign in General Nixon's force. Four Australian flying officers and 41 mechanics and others, with sundry technical equipment but no aeroplanes, left Australia for Mesopotamia early in 1915. In the fighting during that year up to the battle of Ctesiphon one of the Australian airmen was killed and two were captured; the fourth later on entered the Royal Air Force. Of the mechanics and aerodrome personnel, nine were besieged in Kut and later surrendered with Townshend's garrison; two only of the nine survived the rigours of prolonged captivity in Turkey. After this first Mesopotamian campaign the remaining mechanics of the half-flight were despatched for service with the No. 1 Australian flying squadron, then forming in Egypt. This squadron had been raised in Australia and sent to Egypt for war-training; it arrived there in April 1916, began active service in detached flights a few weeks later over the Canal and in Upper Egypt, and took a prominent part in operations throughout the Palestine campaign. Some of its pilots and observers (flying officers) and skilled aerodrome personnel were later ordered to England to provide an experienced leaven for a new 2nd squadron, raised in Australia and sent to England towards the end of 1916. The 3rd and 4th squadrons were built up in much the same fashion round a nucleus of trained and tried officers and mechanics. The 2nd, 3rd, and 4th squadrons served from the end of 1917 till the Armistice on the western front in Europe. Behind each fighting squadron was formed a training squadron at the base—in Egypt and in England respectively—and by 1918 there had sprung up in England a complete Australian training wing, providing reinforcements of flying officers and mechanics for the squadrons at the front.

First Year in France.—Reorganization completed, the Australians were soon required for further fighting. Between March and June 1916 the four infantry divisions were transported to France, and the mounted divisions prepared to take part in the advance of the eastern army under General Murray through the Sinai peninsula. The A.I.F. was thus divided, and from this time forward fought in two separate theatres of war. This narrative is concerned first with the infantry divisions in France, which first went into the line south-east of Armentières, in what was known as 'the nursery sector.' To this sector, the quietest on the British front, were sent all new divisions for 'breaking-in,' and all exhausted divisions requiring a rest. The Germans used this sector in much the same fashion, and Lille, behind the German line, and Armentières, behind the British, were spared, as though by tacit understanding, the artillery bombardment inflicted upon other towns near the front.

While the 1st Anzac corps (1st, 2nd, and 4th Australian divisions), concentrated near Amiens, was preparing to support the Anglo-French attack along the Somme, the 5th Australian division and 61st British division attacked on 19 July from the south of the 'nursery sector' towards Fromelles, with the object of pinning to that front certain German reserves. These fresh troops were about to be withdrawn to the Somme, where the enemy's position had become highly critical; German official narratives published since the war have confirmed what was then suspected, that about the third week of July the weight and succession of British blows on the Somme had very nearly effected the desired 'break-through.' The Verdun offensive was

definitely abandoned; all the enemy's reserves of energy were wanted to hold the Allied offensive, and any operations which prevented or delayed the despatch of fresh German troops to that region of decisive battle were of the utmost service. At Fromelles, therefore, the Australians were fighting the Somme battle as effectively as though they were on the spot. That, however, was not the view they held at the time. The attack penetrated the German lines but failed to hold any part of them; the Australian casualties alone were over 5500; and the failure was declared to be the result of inadequate co-operation on the flank and of non-provision of supporting troops. The heavy day's fighting, however, was distinguished by the gallant conduct of the Australian troops under intense fire.

On the Somme battle-field the Allied offensive had been in progress for three weeks when the Australians first entered it. The Anglo-French attack had bitten out a large piece of the German line, but had come up against several strongly fortified localities, the speedy reduction of which would, it seemed, ensure a clean breach into the open country towards Cambrai and St. Quentin. Against one of these fortified strong-points, Pozières village, the 1st Australian division was sent in on 23 July. It required nearly 48 hours' fighting to win the whole of the village, and the enemy's counter-attacks were especially heavy. The 2nd division then took over the attack and, after a week's stubborn fighting, finally won and held the strong trenches east of the town known as OG1 and OG2, and the famous Windmill position. The Australians were here both sternly tested and fiercely enraged by the Germans' use of *flammenwerfers*. On 7 August the 4th division (which had relieved the 2nd in the line) repulsed decisively a heavy German attack on Pozières, and three days later began a new advance against the next series of strong-points based on Mouquet Farm. Each of the three divisions, in turn or in company, struggled hard for the possession of the farm; twice during August they won it, but were forced by counter-attacks to leave it again. The German losses in these counter-attacks were enormous; one division after another shattered itself against the British line, and particularly the Australian section of it. In September again the 13th brigade of the 4th division twice entered the farm—on 3 September and again on the 5th (with the Canadians)—but each time the enemy recovered it. It fell at last on 25 September to the Canadians, after supporting works had been reduced.

During September and October the 1st Anzac corps was moved to the Ypres salient, and for some weeks garrisoned the line there, but by November it was back on the old Somme battle-field, where active operations had died down under the influence of winter cold, rain, and mud. A few minor attacks on the enemy's trenches and a few night raids for prisoners and other means of acquiring information about the German defences and line of battle, were the only relief to the grim business of holding this line through the bitterest winter of the war. The Somme mud and the Somme cold together tried all troops alike more severely than any other evils of the war. The rain was continuous in a region where artillery fire had destroyed all shelter; the trenches and the shell-torn fields dissolved into muddy bogs, where men and beasts were frequently drowned, or died of exhaustion; and the bitter cold introduced into the army the disease of 'trench-feet.' Trench-feet and influenza sorely reduced the ranks of the Australian battalions, already much worn, physically and nervously, by the preceding hard fighting. Thanks, however, to the splendid work of medical men and of the Y.M.C.A., Salvation Army, comforts and clothing funds endowed by private efforts in Britain and Australia, and similar organizations, the suffering was relieved and checked. In this work the women of the Empire played an unforgettable part.

Bapaume and Bullecourt.—The winter was long and bitter, and the Allies spent it in planning a double attack—British from Arras, French from near Rheims—on the flanks of the great German salient whose point was in front of Soissons. But while they were impatiently waiting for the weather to break, Australian troops holding a position across the Bapaume road perceived on the morning of 23 February 1917 signs that the Germans in front of them were retreating. On receipt of the intelligence British general headquarters ordered an immediate reconnaissance in force along the whole Somme front. During the last days of February and most of March there was stiff fighting with the German rear-guards—for the fact of the retreat was soon established beyond doubt—and the energetic harassing of those rear-guards jostled the enemy out of many positions ahead of his time-table. The 8th brigade of the Australian 5th division, with band playing, entered the long-desired and burning town of Bapaume on 17 March, and then through fields and along roads little destroyed by shell-fire the Australian advance proceeded rapidly for some days. On 21 March the 5th division carried Beaumetz village, lost it, and recaptured it after sharp fighting which entailed much loss on both sides. Lagnicourt was taken by the 2nd division on 26 March and Noreuil by the 4th on 2 April in two spirited attacks which stung the enemy to heavy but vain counter-attacks. A few days later the last enemy rear-guards operating in the open were chased out or captured by the Australian advance, and the corps drew up before the Germans' main position, and prepared forthwith for assault. This main position, known as the Hindenburg Line, was a multiple scheme of earthworks, reinforced by concrete fortifications, and constructed along a naturally strong strategic line linking up fortified villages, the whole defended by formidable fields of wire entanglement. Artillery and machine-gun positions were disposed along its entire length, with ranges plotted and registered. Within this defence system were arranged deep underground shelters for great numbers of men, shelters which would defy the severest bombardment. The work was performed mainly by Russian prisoners of war and by labour conscripted from villages in the occupied territory of France.

The Allied plan previously mentioned was thus foiled in its full design. Nevertheless it still offered considerable possibilities, for the intended French front of attack was not involved in the retreat, and on the British front the prosecution of the offensive offered prospects of gaining the Vimy Ridge, relieving the German pressure on Arras, and turning the northern flank of the Hindenburg Line. The French attack (which was a fiasco) did not begin until 16 April, but on the 9th the British attack was commenced east of Arras, and on the 11th the 4th Australian division was sent in on the extreme right flank of the British operations against the stronghold

of Bullecourt. There was no artillery preparation, as it was intended that tanks (still a new and unfamiliar weapon) should precede the infantry and flatten out the barbed-wire. Most of the tanks were put out of action before they could carry out their task. Still, the 4th and 12th brigades seized the first line, and under a heavy fire reached the second. Unfortunately British troops on their left flank, attacking Bullecourt itself, were held up by immensely strong defences in that village, and when this and other support failed, the Australians had to fall back to their original line. Four days later came the German counter-blow. On 15 April the 1st and 2nd Australian divisions were suddenly assaulted by four picked enemy divisions without artillery warning. The weight of the blow pressed back the Australian line critically, occupied Lagnicourt village, and penetrated as far as some of the Australian artillery positions. But the Germans met a defence as stubborn and alert as their own. Australian defence posts fought their ground to the last man and stayed a deeper penetration of the rear positions, and at the right moment a magnificent counter-attack swept upon the German flank, redeemed Lagnicourt, and drove the attackers back on to their own wire. Trapped before that obstacle, they suffered terrible losses under the Australian machine-guns and artillery.

On 3 May a second and mightier effort was made by the British Third and Fifth armies to break the Hindenburg Line between Queant and the Scarpe. The Australians were again launched to attack on the right flank, between Queant and Bullecourt. Again they entered the Hindenburg Line (with the 6th brigade), but the 5th brigade on the right was held up by heavy enfilading fire from Queant, and the 62nd division (on the left) was again unable to penetrate the Bullecourt defences. Some of the 2nd Australian division (7th brigade) were thrown in against Bullecourt and assisted to force an entry, but were bombed out again in counter-attacks. Only on 12 May, after nine days of the severest fighting, and repeated efforts which drew in all local Australian and British reserves, was Bullecourt finally captured —except a last strong-point on the outskirts, which fell to the British on the 16th. On the 15th the Australians repulsed with great slaughter a massed attack on their right flank by the 3rd Prussian Guards division.

At the end of May the 1st Anzac corps was withdrawn for rest. The 4th division had preceded the others into the rest area on 14 April, after the first Bullecourt action, and was at this time attached to the 2nd Anzac corps near Bailleul, training for a coming attack at Messines. Included in this corps was now the 3rd Australian division, which had arrived in France from England at the close of 1916 and had been holding the line at Armentières. The attack on Messines Ridge, now being planned by the Second army, was really a preliminary operation in a grand British offensive on the whole Ypres-Armentières front, designed to roll up the German right flank and free the Belgian coast from the enemy's grip. The strategic objective was both the denial of the Belgian coast to German submarines and the grappling with the utmost strength of the enemy's field army. British military strength was now at its peak; the German had for some time been on the decline.

Messines to Passchendaele.—The preparations for attack on the low ridge running between Messines and Wytschaete included the firing of a series of enormous subterranean mines under the German front line. The northern end of the ridge looked directly into the southern outskirts of Ypres; from the bend in the ridge at St. Eloi the high ground swept back eastward by way of the spoilbanks of the Ypres-Comines canal, and in a rough semicircle northward again along the Broodseinde-Passchendaele ridge. This high ground had since the autumn of 1914 formed the main German position round the Ypres salient. For nearly two years Australian, Canadian, and British tunnellers had been mining in this region against the German miners; the struggle underground had been no whit less strenuous than the struggle in the trenches above; and at Hill 60—as at Loos farther south, near Lens—Australian tunnelling companies had worsted the German miners at every challenge. The biggest of all the mines for the Messines battle was under Hill 60, but there were several others near the villages of Wytschaete and Messines, which at explosion created tremendous craters. The firing of these mines at an arranged moment before dawn on 7 June gave the signal for the infantry attack. The mines themselves obliterated local enemy trenches; elsewhere the German lines had been pounded out of shape by intense artillery bombardment during the fortnight before the assault. That assault was carried out with complete success, and with astonishingly small loss to the attacking divisions, and the ridge and its reverse slope were captured over their entire length. The advance on the right flank, including the seizure of the southern end of the ridge and the village of Messines, was performed by the 2nd Anzac corps, with the 3rd Australian, New Zealand, and 25th British divisions in line. During the afternoon the 4th Australian division pushed through the New Zealanders' line and continued the advance to a pre-arranged objective. Counter-attacks in the following days were weak and ineffective.

These captures vastly improved the British front for defence, especially by affording artillery observation positions and machine-gun firing positions, which had previously served the enemy well to similar purpose. The gain of the Messines Ridge was especially useful—indeed an essential preliminary—to the British offensive at Ypres which shortly followed. The third battle of Ypres, the hardest and bloodiest of the whole war, began on 31 July, and promptly after its opening the attack was nearly drowned in a fortnight's rain. Besides having the weather to contend against, the attackers had also to meet a most skilfully arranged defence under a new system. The low-lying ground of the Ypres salient forbade the construction of deep underground dugouts, familiar features of the German defences farther south. Moreover, the enemy's faith in these subterranean fastnesses had been shaken by experience; often they had been merely traps for the defenders, unable to get out before an attack had seized the entrances, and then confronted with the alternatives of surrendering at once or being bombed in a pit. At Ypres the German defences, designed in great depth of front and sited to facilitate counter-attack, relied upon immensely strong reinforced-concrete blockhouses, extensively wired and filled with machine-guns. A heavy shell, even when it made a direct hit upon one of these so-called 'pill-boxes,' would frequently ricochet off it. Before these defences, and in weather conditions which made the shell-torn ground one vast bog of mud, the attack

was put to extreme exertion. In four months the entire British army, division by division and corps by corps, had shared in this gruelling trial of endurance, and when winter closed down the battle the German armies on the western front had been equally exhausted and even more discouraged.

The Australian infantry first entered this battle on 20 September, though artillery of the 1st Anzac corps had been engaged in support of the British since 31 July. The advance of 20 September (Battle of the Menin Road) was one of a series of leaps, each designed to recover a definitely limited strip of ground from the enemy along his entire front. The 1st and 2nd Australian divisions performed their part to the time-table and without serious loss; they drove the German line back into Polygon Wood, and the skill of their rehearsed attacking methods was more than a match for the 'pill-boxes.' On the 26th the advance was resumed on the Fifth and Second army fronts; the 4th and 5th Australian divisions took up the attack for 1st Anzac corps, and captured Polygon Wood and the outskirts of the ruined village of Zonnebeke. The most satisfactory advance of all was on the Broodseinde ridge on 4 October; both Anzac corps attacked in this advance, with the 2nd, 1st, and 3rd Australian divisions and the New Zealand division in line alongside each other, and captured the high ground of the ridge for a good half of its length. In this attack British and German plans clashed; the enemy had prepared for an attack on the front held by the 1st Australian division, and meant to launch it at almost the identical moment of the Australian assault; consequently the Australians met great numbers of German storm-troops in 'no man's land,' and completely outfought them in hand-to-hand engagements.

The weather now began to deteriorate. The 2nd Australian division carried out successfully a small advance on 9 October, and on the 12th the 3rd and 4th divisions and the New Zealanders attacked again, but, defeated by the mud and the enfilade fire together, were forced by the end of the day to abandon what ground they had taken. But the British Command was determined to occupy the remainder of the Passchendaele Ridge before the winter, and the advance was resumed in two further attacks, on the 22nd and 30th by the Canadian corps, with the 1st Australian division on its right. Finally on 6 November the Canadians in a last effort reached and held Passchendaele village and the limit of the ridge.

The close of the 1917 campaign on the western front was notable in the A.I.F. for the appearance in France of three squadrons of the Australian flying corps. No. 3 squadron (two-seater machines) arrived in September, followed later in the same month by No. 2 squadron and in December by No. 4 squadron (each consisting of single-seater fighting scouts). A number of their leading pilots had been previously attached for experience to British air-squadrons on the front and therewith had taken some temporary part in air operations during the third battle of Ypres. No. 3 squadron (Blake's), after a few weeks' front-line training in September and October near Arras, was attached to the 2nd Anzac corps at Bailleul. No. 2 squadron (Watt's) played a prominent part in the successful attack by Byng's Third army at Cambrai on 20 November—in which the 2nd Australian siege battery took part—and in resisting the equally successful German counter-attack there ten days later.

The Australian Corps.—Another landmark of this period was the reorganization of the Australian divisions. On 1 January 1918 all five divisions in France were brought together into one corps. General Birdwood retained command of the corps till May 1918, when he was promoted to command the re-formed Fifth army, and was succeeded as corps commander by General Monash from the 3rd division. The Australian corps, with No. 3 squadron A.F.C. operating as its corps flying unit, spent the winter till mid-March in the line along the Messines ridge from Warneton to Hill 60, conducting several highly successful infantry raids in strength on the enemy, and elaborating defences in depth against a German offensive, of which the Australians, in common with the rest of the British army, were warned. Meanwhile No. 2 squadron A.F.C. operated on the front of the Third army opposite Douai, and No. 4 squadron (McClaughry's) on that of the First army between Lens and Lille. They had several notable fights, and in February a flight of No. 4 squadron fought its first engagement with Richthofen's famous 'circus' squadron near Lens. A strong patrol under Cobby (No. 4 squadron) met it again, and severely mauled it, in a fog near Bapaume just before the German offensive in March.

The German Offensive.—The beginning of that offensive on 21 March 1918 at St. Quentin, and the rupture after three days of the attenuated line of the Fifth army, marked the most serious crisis on the western front since the battle of the Marne in 1914. The 2nd Australian tunnelling company was involved in the retreat of the Third army's right flank near Havrincourt Wood, and took part in the demolition of bridges and supply dumps—though this work was inadequately done, owing to the non-supply of promised explosives. By the 22nd the Australian corps in the north was, like all other British reserves and some French divisions, under orders for Amiens, to prevent the threatened separation of the Allied armies. The 3rd and 4th Australian divisions, being in rest areas behind the Messines front, were the first to go; they moved in haste, by train and motor-lorry, and concentrated about Doullens on the 25th and 26th. The 4th brigade (4th division) went into action at Hebuterne and remained there detached for nearly a month. The other two brigades of the 4th division swung south-eastwards to Albert, and occupied just in time a line on the western bank of the Ancre that barred the road to Amiens. Upon this line the British, retreating in good order but considerably exhausted, fell back during the next two days. Meanwhile the 3rd Australian division passed the Ancre and dug in across the Morlancourt ridge (between the Ancre and the Somme) from a point in contact with British units and the 4th division near Dernancourt to Sailly-le-Sec on the northern bank of the Somme. On arrival here the 3rd division immediately attacked German advance-guards and drove them back about half a mile. With the arrival of the 5th Australian division to support this Ancre-Somme line on the 29th, the 9th brigade (3rd division) was sent across the Somme to Villers Bretonneux, to assist the sorely-pressed and weary rear-guards of the Fifth army to make a stand there on the main eastern road into Amiens.

In this region the German advance was thus stopped, but on 4 and 5 April, when the enemy's

immediate reserves came up, a renewed attack was delivered in considerable strength of numbers, but without the full weight of artillery that had been assembled on 21 March. The comparative weakness of this second attack was due in great measure to the gallantry of the Allied airmen (including the two Australian scout squadrons), who from the first day of the German offensive ceaselessly bombed and machine-gunned every road by which the enemy was pressing on in his advance. The adjacent fields were still boggy with the mud of the winter; all wheeled traffic was obliged to keep to the available roads; and time and again the crowded traffic of these roads was smashed by the air squadrons, to the great damage and still more serious delay of the German supply columns and artillery. The value of this harassing work was inestimable.

Villers Bretonneux.—The attack on 5 April at Dernancourt and Albert was repulsed by the 4th Australian division and the British to the north of them. Heavy German infantry assaults were directed especially against the Australians, and penetrated the line temporarily at a point where the fire of their artillery had been concentrated to produce the utmost effect. More critical was the position at Villers Bretonneux, south of the Somme, at the other horn of this double thrust upon Amiens. Here on 4 April the 9th Australian brigade, together with the thin British line on either side of them and the French at Hangard on the Luce, withstood a blow which taxed their resistance to the utmost. Hamel village was lost and the woods near by it. So was Hangard; Hangard changed hands several times in the next few days. But the enemy's main objective was Villers Bretonneux, which would have given them a hill-position commanding Amiens and the immediate rear of the British line north of the Somme, and would have opened the principal road from the east into the city. Birdwood regarded Villers Bretonneux as the key to the whole Amiens position. The Australian 9th brigade, and the tireless British cavalry operating with them, were forced to give ground east of Villers during the morning and afternoon, but held their front intact under repeated assaults, in spite of a bombardment by high explosive and gas shells which wrecked the town behind them and smashed their communications. The line held on all day in ignorance of what had happened in its rear and on its southern flank; but towards evening the 9th brigade's right flank itself recoiled, and the enemy reached the southern entrance to the town. A desperate counter-attack, to which the last man of the meagre local reserves was committed, restored at midnight the Australian right, and for the moment the position was saved. Next evening the vanguard of the 2nd Australian division (5th brigade) arrived at Villers Bretonneux to relieve the 9th. During the next fortnight the British line here was reorganized, and the Germans made no more hurried attempts against Villers. They also were consolidating their line. There was some desultory fighting about Hangard, but of no important effect.

By the second week in April the Germans had diverted their stroke to the north. Their first blow had failed to separate the British and French armies and to reach Amiens. The able but costly retreat of the British Fifth and Third armies had minimized the effect of that blow, and the British final stand with fresh troops denied Amiens to the enemy. But the defeat of the design to shatter the British line was marked most clearly in the bloody repulse of the enemy by the Third army at Arras on 28 and 29 March. Arras was the main bastion of the whole British line at this critical period; it was proclaimed as such by the enemy's effort, by the British resistance, and by the results of the offensive in this region. In order either to turn the Arras position from the north, or to pin down British strength in Flanders, or to pursue in a new direction the advantage of the initiative which still remained to them, the Germans on 9 April assaulted in strength the line between Armentières and Bethune, thrusting their heaviest weight against a Portuguese division east of Estaires. Breaking through here, they overran the Lys flats and Armentières, and eventually the Messines ridge. At Bethune they were stayed by the valiant defence of the 51st division; but at Messines they found opposed to them divisions which had been exhausted and reduced during the previous retreat from St. Quentin in the south, and had been sent here for a rest. After a week of severe rear-guard fighting the British line, weak and with few immediate reserves, rallied in front of Hazebrouck and Caestre. The 1st Australian division, ordered south to Amiens at the end of March, had no sooner reached the Somme than it was ordered back in haste to assist the northern defence, and went into action under the low rise of Strazeele on 12-13 April. During the remainder of the month the position in Flanders remained dangerous; Bailleul was lost, and French reserves were driven off Mount Kemmel; but the line south and east of Ypres, after yielding ground hard-won during the previous year, somehow held fast, and the Germans made no more progress thereafter towards the Channel ports.

About the time of the fall of Mount Kemmel, bringing consternation to the British who had occupied it throughout the war, Villers Bretonneux was also seized in a sudden attack on 24 April by four German divisions assisted by tanks. The British 8th division here had taken over the defence of the town from the Australians, the 5th Australian division being posted in the line immediately north of Villers, before Hamel and on Hill 104. The situation called for counter-measures without loss of time, and that night the 13th and 15th Australian infantry brigades—the only fresh reserves immediately available—delivered a memorable counter-attack which began at 11 p.m. and ended at the dawn of the anniversary of the Anzac Landing. The 15th brigade attacked north of the town past the edge of Hill 104, the 13th south of the town across the flats beyond Cachy village. Each assaulting column faced considerable difficulties. The ground had been but slightly reconnoitred; the chances of losing direction on a dark night were many; the strength of the enemy was unknown; and the instructions to the troops were to neglect all flanking fire from Villers or the edge of the wood behind Villers. The plan was to squeeze the Germans in the town between the jaws of these pincers, and its success equalled the Australians' wildest hopes. By dawn the counter-attack had practically reached the old defensive line north and south of the town, and Villers was surrounded on three sides; thereafter the Germans in Villers were without difficulty killed, captured, or driven out through a rapidly closing exit. This night attack was for some months regarded, in the

public eye at any rate, as the finest Australian feat of arms on the Western front.

The ensuing three months—during which the Allied armies slowly recuperated from losses and disorganization—were marked on the British front by several brilliant minor offensive actions by the Australian corps, and on the French front by the exhaustion of the German effort. During May, June, and July the Australian corps carried out a series of attacks along the Morlancourt ridge, all limited actions by one brigade or another, and all completely successful in winning ground, exhausting the German strength, and impressing upon the enemy the superior morale of his opponents. This little campaign culminated on 4 July in the assault and capture of Hamel village and the surrounding positions by three Australian brigades (4th, 6th, and 11th), some American battalions being incorporated in the attack for instruction in this art. The careful staging of this battle by Monash, and the splendid results achieved with a maximum loss to the enemy and at very slight cost to the attack, greatly raised Monash's prestige with the British high command. Following this battle, several weeks of perpetual Australian raiding east of Villers Bretonneux reduced the nerves of the German line-troops nearly to breaking-point; and in Flanders the 1st Australian division, entrenched opposite Merris, employed precisely similar tactics and with equally satisfactory results.

The August Offensive.—Meanwhile the German offensive had exhausted itself, its last success being the penetration of the French line southwards on the Marne; this movement was thwarted and a retirement towards the Aisne compelled by Foch's counter-stroke on 15 July from the forest of Retz. While the Allied success was being exploited to the full east of Soissons, a general counter-offensive was planned, and the execution of the first stroke in it entrusted to the Australian and Canadian corps in conjunction with French troops on their right flank. On 8 August the two Dominion corps, secretly assembled in strength behind Villers Bretonneux—Australians to the north, Canadians to the south—were hurled against the German lines between the Somme and the Roye road. Behind a great array of tanks (which took the place of the usual artillery preparation) the attack went through the enemy's defences swiftly and easily. On the Australian front the 2nd and 3rd divisions pushed it to their appointed limit; then the 4th and 5th divisions, passing through them, pressed forward towards their final objective—to the consternation of the Germans, who found their artillery positions and guns submerged, their reserves broken up before they could assemble, and cavalry and fast tanks completing the wreckage in front of the assault. What this battle meant to the Germans was revealed later by Ludendorff, who said 'After this severe defeat I gave up the last vestige of hope.' The advance of six miles on the first day was continued for some distance next morning by the 1st and 2nd Australian divisions. By the 11th the enemy's resistance, stiffening south of the Somme, had been broken on the Morlancourt ridge after much difficult fighting, and the British-Australian line ran immediately west of Meaulte and Bray. The enemy's plans, whether for leisurely retreat or for a stand, were overthrown on the 22nd by decisive blows at two points. The 1st Australian division stormed the German position in the gullies at Chuigny and Chuignolles (south of the Somme, at Bray), while the 3rd Australian division advanced on the northen side of the river; and the British Third army made a new attack upon Bapaume from south of Arras. These blows set in retreat the whole German line from the Scarpe to beyond the Somme; but by the end of August the enemy, shaken but not yet broken, came to a stand on the Somme bend at Péronne, and on the high ground that runs northwards by Mont St. Quentin to the Bapaume plateau.

Mont St. Quentin.—Along the Somme valley the Australian 3rd and 5th divisions conducted the pursuit of this retreat with all energy, and, as soon as resistance stiffened, again prepared to attack. The 5th division found the Somme crossings south of Péronne strongly held; the 3rd found the Germans in strength on rising ground beyond Clery—the Bouchavesnes spur and Mont St. Quentin; as soon as it could come up, the 2nd division thrust its 5th brigade between the 3rd division and the Somme. At dawn on 31 August the 5th, 10th, and 9th brigades in line began the assault. A determined and successful attack of the 9th on the Bouchavesnes spur enabled the left and centre of the advance to reach the main Péronne-Bapaume road; the 5th won the summit of Mont St. Quentin, but during the afternoon was obliged by heavy counter-attacks upon a weakened line to give some ground. Next day the 6th brigade (2nd division) retook and held Mont St. Quentin, while the 11th brigade (3rd division) pushed on the left to Allaines; but the main burden of the battle on this second day was borne by the 5th division in its advance on Péronne. The town had many facilities for defence, and was strongly defended; the 14th brigade, attacking from north of the Somme, eventually secured a footing in the western part of Péronne, while the 15th found a crossing over the river opposite Flamicourt, and thus joined up inside Péronne with the right of the 14th. A renewed attack on 2 September by these troops, aided on their left by the 7th brigade (2nd division), forced the Germans out of their remaining hold on this strong position, and by the 5th the enemy was in full retreat again. About five days later he came to another stand in front of the Hindenburg Line, in what had been the British line of early 1918, and was now known as the Hindenburg Outpost Line. Meanwhile, on the 2nd the Canadians had already overrun the northern end of the Hindenburg Line (the Drocourt-Quéant sector) in a smashing attack. The effect upon the enemy of the blows of August and early September was so considerable that the Allied high command revised its calculations for a conclusion of the war in the spring of 1919, and resolved to press its present advantage to the utmost. On 12 September the Americans (assisted by the French) drove the Germans out of the big salient at St. Mihiel in Alsace, which the enemy had occupied since the beginning of the war. A fortnight later the King of the Belgians led a combined Belgian, British, and French attack from Ypres, which tore down the remaining enemy defences on the sea-flank, and opened the advance on Antwerp and Bruges. A timely defence of their centre seemed the Germans' only hope of averting a mightier and an avenging Sedan. This defence depended absolutely on the central section of the Hindenburg Line, and upon this three British armies threw their full weight.

The Hindenburg Line.—On the front of the British Fourth army the assault was begun on 18 September, when the 4th and 1st Australian

divisions attacked in the centre of that army's line, with British divisions on either side of them. The effort was completely successful, and on the Australian front was remarkable for the unexpectedly light cost in casualties. Except for a difficult locality on the Fourth army's left front, the whole of the Outpost Line was taken. This action brought the army directly against the Hindenburg main line, and, as soon as fresh troops could be brought up and the artillery could be placed in position, another move forward was initiated. A preliminary attack on 27 September by American troops on the Guillemont farm position (from which the Germans had not been dislodged) did not succeed, but the failure was drowned in the great roar of the British bombardment along the whole front, which opened on that day and was maintained for forty-eight hours. Had the American action of the 27th been a success, the more serious failure by those same troops on the 29th might have been avoided, and the Hindenburg Line might have been ruptured more quickly and with far greater loss to the enemy. There was, however, no time to reconsider plans for the improvement of the short American front, or to stop the vast machinery which had been set in motion. After two days' bombardment three British armies (and south of them the French) were launched in simultaneous attack.

To the north of St. Quentin it was planned that the Australians should push through on the heels of an initial attack by the 27th and 30th American divisions (attached to the Australian corps). The American advance melted away, partly by reason of having first to carry some German machine-gun defences near Guillemont Farm before it could reach its opening artillery barrage, partly through the inexperience of these raw troops in the work of 'mopping-up' German posts as the advance progressed. By the middle of the forenoon, when the 5th and 3rd Australian divisions were preparing to push through and continue the assault, they found that the American attack had been broken up and that the work was all to be done again from the outset, and without artillery barrage. Thanks to the resolute fashion in which the British 46th division, on the right of the Americans, swam the canal in life-belts, scrambled up the brick wall on the other bank, and drove into the enemy's position, the 5th Australian division (or at any rate its right wing) made good that side of the attack; but the advance of the 3rd division towards the canal tunnel and Le Catelet became much confused. Throughout the 30th the direction of the attack swung perforce from eastward to north-eastward, in response to German resistance about Bony village, but by the evening of 1 October hard infantry fighting had broken the back of the resistance, and the 5th division was pounding at the last of the German trenches, the Beaurevoir line. On the 3rd the 2nd division took over charge of the Australian line (all the Allied front was now steadily diminishing in length), and opened the last stage of the battle. The 5th and 7th brigades broke through the German defences, and the 6th brigade completed the work by pushing forward along the high road to Le Cateau and capturing German defences about the village of Montbrehain. On the evening of the 5th the 2nd Australian division was relieved in the line, and withdrawn to join the other divisions which had preceded it into rest areas.

The Australian corps saw no more fighting. After nearly a month in rest it was, in early November, on the march towards the front again when, after the battle of Landrecies, came the news that the enemy was asking for an armistice. But some Australian field artillery took part with the British in the last fighting; there were Australian tunnellers in the advance-guard of the British Fifth army east of Lille, moving towards Mons; and overhead the two Australian squadrons of fighting scouts fulfilled to the last their share of the work of hunting down German airmen. During October some of the biggest air battles of the war were fought over Tournai and Courtrai, in the final effort of the German air service to prevent British and Australian scouts from harassing the retreat.

The corps wintered about Charleroi, and in the spring of 1919 was gradually withdrawn from France, demobilized in England, and its soldiers repatriated to Australia. Of the A.I.F. only No. 4 flying squadron found place in the limited British army of occupation on the Rhine. It spent some two and a half months at Cologne.

The Light Horse.—The campaign in Sinai and Palestine began with some minor operations in the desert just east of the canal by Australian and New Zealand mounted troops in the spring of 1916. Hitherto the task of General Maxwell (commanding in Egypt) had been to defend the canal zone. The instructions to General Murray, who succeeded Maxwell early in 1916, went further; he was to attempt the re-conquest of the Sinai peninsula. In the summer Murray's troops held Romani in force, with outposts at various hods (palm-groves, marking wells) to the east of that place. Here early in August he was beset by a force of 18,000 Turks under Kress von Kressenstein, who, having driven in or captured the outposts, attacked the Romani position in force on 3 August. The Australian light horse gallantly withstood the brunt of this attack on the southern flank, unassisted by reserves until the enemy should commit his full strength. Time was vital, for the Turks were fighting for water as well as for victory. By the end of the day the enemy had done his worst, and a counter-attack of the New Zealand mounted rifles and light horse reserves drove back the wearied assailants, with over half their force either casualties or prisoners, first to Katia and then upon El Arish. There was no further serious fighting in the Sinai desert; need for establishment of sure communications rather than the enemy's resistance delayed Murray's entry into El Arish until 20 December. On the 23rd the Anzac mounted division marched on an enemy force at Magdhaba, on the right flank, and after a battle lasting all day stormed the Turkish position at dusk. The same division repeated this exploit on 9 January 1917 by the capture of Rafa in similar circumstances; in each instance a stout resistance was overcome only at the last moment, and by a general charge; and the issue at the end of the day—as with the Turks at Romani—was not merely the success of the attack but the procuring of water for men and horses. Murray's army was now at the entrance to Palestine, secured from any molestation on the desert flank, and encouraged by the knowledge that Arab tribes under the Sherif of Mecca had revolted from their Turkish masters. Across the desert had been laid a road of wire-netting, and the building of a railway from Kantara by Egyptian labour had been begun. Murray, having assembled his forces at El Arish, launched on 26 March an attack on Gaza which very nearly succeeded. The mounted troops fought their way round the enemy's land-

ward flank, attacked the Gaza position from the east and north, entered the outskirts of the town itself, and captured a Turkish divisional commander; but on the south of Gaza the infantry attack was held up, and, in the face of approaching enemy relieving columns, the disappointed Australians and New Zealanders on the north had to be withdrawn from the very threshold of victory. It was said afterwards that the commander of the Turkish garrison in Gaza had prepared to surrender, and accounted it a merciful dispensation of Allah that his enemy voluntarily disappeared. On 17 April a second attack on Gaza failed signally, and thereafter the British sat down in trenches before the enemy to prepare for a regular campaign. Murray was replaced in command by General Allenby from France; the army was considerably increased in infantry and artillery strength (even tanks were added to it); and it was decided that for the successful operations of this augmented force the completion of the railway across the desert from Kantara was essential. The whole summer and early autumn of 1917 were spent in this laborious undertaking, and in October the railway had reached Allenby's front, and a water-pipe line had wormed with it across the waste of sand-dunes.

Beersheba.—Meanwhile the enemy had been working with equal industry. The Gaza defences were strengthened and prolonged in a regular fortified system as far as Beersheba (a front of twenty miles); and German engineers were completing with all haste an extension of the Turkish Palestine railway from Nazareth and Jerusalem to serve the Gaza line. By the time Allenby was ready, the Gaza-Beersheba position was from the front almost impregnable, and was defended by a Turco-German army of about 200,000. The situation indicated an attack in flank—which involved a considerable extension of the line of assault. Allenby's plan was that the XXI corps should engage the defenders of Gaza and the XX corps those of Beersheba, while the Desert Mounted corps under Chauvel swept round the enemy's left flank to attack Beersheba from the east and north. Upon success at Beersheba depended the whole battle. Chauvel's force started out in the night of 27 October on a wide detour through oases of the eastern desert, and three evenings later had turned and was marching on its real objective. At dawn on 31 October, while two divisions of infantry opened the frontal attack on Beersheba, the Australian and New Zealand horsemen (with British yeomanry in reserve) went into action against Turkish positions in the hills near the Hebron road behind the town. Their efforts through most of the day were devoted to reducing the strong defences on Tel-el-Saba hill, but these resisted stubbornly until mid-afternoon, the day was wearing out, and still the main task remained to be performed. At 4 p.m. Chauvel, instructed that further delay would be fatal, ordered the 4th light horse brigade to charge the Beersheba eastern defences. The order committed the brigade to a two-mile gallop under shrapnel against trenches of unknown quality, which had not been reconnoitred. With the utmost eagerness the 4th and 12th light horse regiments dashed at the enemy. The troopers carried neither sword nor lance; they rode with bayonets fixed to rifles, or bayonets bare in their hands. At eight hundred yards from the enemy they came under heavy machine-gun and rifle fire, but undaunted—and unconsciously establishing a precedent for mounted action in this campaign—they galloped unswervingly at the double line of trenches now disclosed ahead of them. Fortunately these earthworks were not wired. The horsemen took the obstacles (one of them ten feet deep and four feet wide) in their stride, threw themselves from their horses, and leapt into a hand-to-hand contest with the defending infantry. Meanwhile the remainder of the Anzac mounted division came up in a cheering rush and swept into Beersheba town, and the troopers of the 4th brigade, having killed, captured, or put to flight the defenders of the trench system, joined their comrades in Beersheba. The enemy soon abandoned the attempt to fight. Infantry, gunners, and transport drivers fled in rout through the streets, and the Turkish position was definitely turned. Meanwhile the XXI corps had begun its attack on Gaza with the capture of the important Umbrella Hill. During the ensuing days the XX corps and the cavalry continued the rolling up of the enemy's left flank, and on 6 November captured Sharia, in the centre of the defenders' line. That same night the Turks evacuated Gaza, abandoning great quantities of stores, and next morning the pursuit began up the floor of Palestine. The cavalry, assisted by the air force, hustled the rear-guards relentlessly; valuable supply stores, ammunition dumps, and aircraft equipment were seized at Et Tine and other places. Ramleh, Ludd, and Jaffa were occupied by the cavalry advance-guards, and on 19 November the advance threatened Jerusalem. The Holy City was spared a projected attack by the Turks' withdrawal on the night of 7 December. The retreat came to a standstill in the hills south of Nablus, and here trench-warfare was gradually resumed. A Turkish attempt to recapture Jerusalem on 27 December failed; it was merely the precursor of a renewed advance on this flank, and after some successful minor operations the Anzac mounted division and two infantry divisions pushed out on 19 February 1918, captured Jericho, and reached the Jordan.

The Jordan Valley.—Meanwhile the Arab rising along the desert railway beyond the Dead Sea was causing the enemy serious concern, and Allenby's policy was to encourage these auxiliaries and endeavour to effect a junction with them beyond the Jordan. In order to hamper the Turks about Maan, whom the Arabs were seeking to envelop, Allenby decided to despatch a strong raiding force across the Jordan to seize Amman and destroy at that place a viaduct on the railway line. This force—consisting of an infantry division, the Anzac mounted division, the camel brigade, and artillery armoured cars—crossed the Jordan on 23 March after some opposition, and pushed north on Es Salt and east on Amman. Es Salt was occupied two days later, and on the 26th and 27th the Australians and New Zealanders attacked the railway south of Amman. A section of the line was destroyed, but the demolition parties failed to reach the viaduct. A mounted attack on Amman town on the 27th met with strong opposition, and a general attack assisted by the infantry next day also failed. Hot fighting continued here until the 30th, when the arrival on the Jordan and at Amman of Turkish reinforcements obliged the raiding force to break off the attempt. The retirement was skilfully carried out, and by 2 April the whole force had re-crossed the Jordan, leaving a garrison on the farther side to hold a naturally strong bridge head at Ghoraniyeh. On 30 April a second raid was made across the Jordan with the object of capturing the Shunet

Nimrin position, which the Turks had meanwhile considerably fortified. While the 60th division prepared to attack this place in front, the Australian mounted division moved by night against Es Salt and occupied that town in the evening of the 30th. The Turks, however, were more prompt than previously with counter-measures. A cavalry division and some infantry were hurriedly thrown across the Jordan at the Jisr-ed-Damie ford, west of Es Salt; and the light horse, thus heavily attacked in flank, found their attention much distracted from their pre-arranged task, which was to turn the Shunet Nimrin position from the north. After several days' severe fighting in defence of the road of retreat by Umm-es-Shert, the light horse at Es Salt were obliged to retire while there was yet time, and the attack on Shunet Nimrin was abandoned.

The Great Ride.—For some months Allenby's plans for further offensive operations were held in abeyance. Summer in the Jordan valley descended with all its severity on the army in that region, and all British troops that could be spared from Palestine were ordered off to France to reinforce the stricken line on the Western front. An attack in force by German troops along both sides of the Jordan on 14 July succeeded temporarily in capturing the important hill of Abu Tellul, but a prompt counter-attack by the 1st light horse brigade recovered it. Meanwhile, the withdrawals of British cavalry and infantry (amounting to nearly four divisions) from Allenby's army were made good by the arrival of Indian cavalry and infantry, two Jewish battalions, some Armenians and Algerians, and coloured troops from the British West Indies and South Africa. It was an army of mixed races and colours which Allenby finally launched in attack against the Nablus position on 19 September. The features of this famous battle, fought (in part) on the plain of Armageddon, are well known. The German command was deceived partly by its experience of the raids on Amman and Es Salt, partly by the skill of Allenby's preparations, into thinking that the attack would come by way of the Jordan flank rather than on the Mediterranean side—where the defences were perhaps stronger, where there was little ground for manoeuvring, and where help from the Arab tribes would not be available. An important factor in the British surprise was the work of the air force, in which the star squadron was No. 1 squadron of the Australian flying corps. Allenby's concentration on his left wing could scarcely have been concealed from enemy observation—in spite of the dummy camps and pretended activity on the Jordan side—if that enemy had been able to conduct the usual reconnaissances by air. But during most of August and all September air reconnaissance was denied to the German airmen; as soon as they appeared, the British (and notably the Australian) airmen attacked them and drove them off, generally destroying them in air combat. There was no air work so entirely effective done at any other time or on any other front during the war. When on 19 September Allenby's infantry broke through the Turkish lines on the coast with a massed attack, and the cavalry immediately started on its famous ride round the enemy's rear, the surprise of the Germans was complete. The ride was entrusted to the Desert Mounted corps under Chauvel, and in it participated the whole of Allenby's mounted force (12,000 strong) with the exception of the Anzac mounted division, which remained on the Jordan. On the morning of the 20th the Indian cavalry entered Nazareth, to the consternation of the German supply service; the Australian mounted division was in Jenin, and rolling up what was left of the Turkish flank in the hills north of Nablus. During the next few days Beisan and other points in the Turkish rear were seized, and the fate of the Turkish 7th and 8th armies, still at Nablus, was sealed beyond doubt. When the news of this shattering blow reached the headquarters of those armies, their retreat speedily became a rout. The only road left open for their retirement was north-east from Nablus by way of the precipitous valley of the Wadi Fara, and in the general direction of Deraa Junction (north of Amman) on the desert railway. In the defiles of the Wadi Fara columns of Turkish transport, artillery, and marching troops were butchered under bombing attacks of the British airmen, and the greater part of this work was done by No. 1 Australian squadron. By the end of the month the Turkish 7th and 8th armies had ceased to exist; their entire force, with negligible exceptions, had been either killed or captured. Meanwhile news of the disaster spread to the Turkish 4th army, east of Jordan. At the first sign of alarm on that side the Anzac mounted division under Chaytor and the few infantry battalions left to hold that flank with it, crossed the river and began the advance on Amman, which was captured on 25 September. There was little enemy resistance; the local Turkish and German forces concentrated solely on flight towards Deraa (already closed to them), and upon these fugitives, too, was visited near Mafrak the fury of No. 1 squadron's air attacks. On 29 September a Turkish corps, marching along the railway northward from Maan, surrendered near Amman to Chaytor.

Chauvel's cavalry, having concentrated about the Lake of Tiberias, was now in rapid movement towards Damascus, and so were the Arab tribes on the desert side, each striving as much for the honour of being first in the Syrian city as for the rounding up of the handful of Turkish fugitives who were making northward from Deraa. Chauvel had to fight determined rear-guards (chiefly German machine-gunners) at Jisr Benat Yakub and at Saza on the way up to Damascus. On 30 September the light horse passed aside from Damascus to cut off the enemy's retreat north-west by way of the Abana gorge; having succeeded in that enterprise and captured 4000 more prisoners, they sent the 5th light horse brigade into Damascus in the early morning of 1 October. Fighting was now at an end, and October was spent chiefly in the hurried pursuit of a few thousand Turks through Beyrout, Homs, and Hama to Aleppo, which was reached by the armoured cars on the 23rd. The Turkish armistice was signed on 31 October 1918, and its terms involved the unconditional surrender of Turkey.

Detached Work.—To complete the record of the A.I.F.'s many theatres of action during the war, mention must be made of the Australian wireless signal squadron (120 officers and other ranks) which joined the British force in Mesopotamia at the end of 1916, and served with it until the end; of the small party of selected Australian officers and men from France who in July 1918 joined the British North Russian Expeditionary Force for the defence of Archangel and the Murman coast; and of the volunteers with General Dunsterville's force in Caucasia in 1918. The Caucasian operations were remarkably adventurous. One hundred officers and 250 sergeants were selected from the

army in France for special duty in training Persian and other local levies for operations near the Caspian Sea; and of these 18 officers and 20 sergeants were from the A.I.F. During August and part of September Dunsterville's force made a spirited defence of Baku against strong Turkish attacks—the object of the expedition to Baku was to save the oil wells—but finally was forced to withdraw, owing to lack of expected aid from the local populace. Dunsterville's operations, however, saved northern Persia from a threatened Turkish invasion.

The repatriation of the men of the A.I.F. from England and Egypt went on during most of 1919 and 1920. Many of them were sick, wounded, or permanently incapacitated, and continued in Australia to be patients in military hospitals. While they and the hospitals remained under the control of the defence department, the A.I.F. had not quite ceased to exist. The last formal action which converted these men into civilians, and the hospitals into civilian hospitals, was taken on 1 April 1921. On that date the Australian Imperial Force passed finally into history.

A.I.F. Badge.—It should be noted that the badge of the A.I.F., often called the Rising Sun, has really no connection with that object. It originated as a badge for a regiment of light horse that was the first Federal contingent to serve in the South African war, and was designed to imitate roughly a trophy of arms (swords and bayonets surrounding an imperial crown) in the possession of Sir Edward Hutton, who then commanded the Commonwealth military forces. In 1903 a Birmingham firm, asked to design a badge for the whole of the Commonwealth forces, adopted this light horse badge and, not knowing its origin, deviated still further from the trophy pattern. This design was at first worn only by staff officers, but on the introduction of universal training came into general use, and was naturally adopted in 1914 by General Bridges for the distinguishing badge of the A.I.F.

Battle Honours.—In allotting battle honours to any unit of the military forces it is required that headquarters and at least half the strength of the unit shall have been present at the engagement. Under these conditions Australian units may be allowed to emblazon on their colours one or more (up to ten) of the following:—

A.N. & M.E.F.: Herbertshohe (properly Kabakaul, as there was no fighting near Herbertshohe).

A.I.F.: (1) on Gallipoli: Landing at Anzac, Defence of Anzac, The Chessboard, Quinn's Post, Lone Pine, Russell's Top, Hill 60.

(2) on the Western Front: Fromelles, Pozières, Mouquet Farm, Retreat to Hindenburg Line, Bullecourt, Lagnicourt, Messines, Menin-Road Ridge, Polygon Wood, Broodseinde, Passchendaele, Ancre, Villers-Bretonneux, Hamel, Hazebrouck, Meteren, Amiens, Chuignes, Mont St. Quentin, Havrincourt, Epehy, St. Quentin Canal, Beaurevoir.

(3) in Egypt and Palestine: Senussi operations, Romani, Gaza, Jerusalem, Jericho, passage of Jordan, Jordan Valley operations, Tel Asur, Megiddo, Damascus.

The actual allotment is still in progress (1925). F.M.C.

Australian Salmon, a percoid fish of the genus *Arripis;* its exact affinities are somewhat uncertain. There are two species, *A. trutta* (Sea Salmon) and *A. georgianus,* both occurring in the

Sea Salmon.

temperate and cooler waters of Australia, and moving in vast shoals along the coasts. Though commonly known as 'salmon,' they have neither resemblance to nor affinity with the true Salmonidae, although the young are ornamented with markings somewhat similar to those of trout, and are therefore—equally incorrectly—known as salmon trout. Though not regarded as of much value as food-fishes in Australian markets, these salmon are sold in considerable quantities by fish-hawkers. At Lord Howe Island they grow large and fat, and are excellent eating when baked. Large specimens (20-30 inches long) afford excellent sport to anglers, leaping clear of the water and fighting valiantly for their freedom when hooked. *A. georgianus* is common in the southern markets, and is known as 'roughy' in Melbourne and 'tommy rough' in Adelaide; but it must not be confused with the New South Wales 'roughy,' which is *Trachichthys australis,* a distant relative of the nannygai. A.R.McC.

Australind, a small township of Western Australia situated on Leschenault Inlet seven miles north of Bunbury, the relic of an ambitious colonization scheme put forward in 1839 by the Western Australian Company (not to be confused with the Western Australian Association). The early colonization of Western Australia (q.v.) involved a series of misadventures. The great difficulty was the lack of labour, convicts being excluded and free immigrants being almost unobtainable for lack of funds to bring them out, while the large grants of land made to the first settlers involved the scattering of the community over a very considerable area. After much unsuccessful negotiation with the British government, the Western Australian Company was formally constituted in 1840, and decided to buy land from a private owner and sell it to small farmers from a plan available in London. The area selected was a grant originally made to a Colonel Lautour near the mouth of the Collie River on Leschenault Inlet in Geographe Bay, where there was already a whaling station and a depot for breeding horses for India. After some delay—caused partly by a report that Lautour's grant had been resumed by the colonial government, partly by George

Grey's adverse opinion of the Leschenault district and desire to get the settlement shifted to the neighbourhood of Geraldton—the ship *Parkfield* in March 1841 brought out the first batch of settlers, and found herself anchored near 23 American whalers. The town of Australind, a magnificent conception intended to cover 1000 acres—besides the reserves for public buildings, churches, hospitals, colleges, pleasure-grounds, quays, markets and cemeteries—was already laid out; but the 100-acre 'rural' allotments, on the clearing and cultivation of which the whole scheme depended, were still bush, and remained bush for many years. Labour was no more easily found by this scheme than by any other; the emigrant labourers for whom a free passage was provided preferred to go to the eastern colonies, and the settlers who had purchased land, expecting to live in the town and get their farms cultivated by hired labour, found themselves compelled to do their own work or starve, though they were, as a rule, unfit to do farm work even under English conditions. In 1843 the scheme collapsed, and Australind decayed, its one sound asset—the safe harbour—being exploited more satisfactorily by the newer settlement of Bunbury at the mouth of the Inlet. Not till 1875, however, was it decided to wind up the company, and the final proceedings took several years to complete.

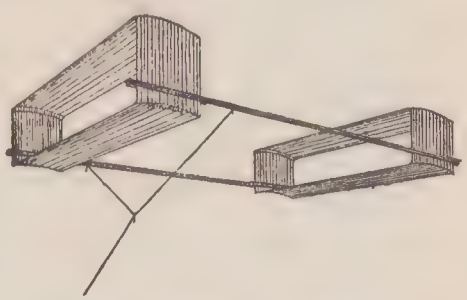
See *Western Australia and the Settlement at Australind*, published by Smith, Elder & Co. in 1842.

J.S.B.

Aviation. In March 1851 Dr. William Bland (q.v.) designed an 'atmotic ship,' drawings of which he sent to England for the Great Exhibition of that year; they arrived too late, but a model of the machine was shown in 1852 at the Crystal Palace. This 'ship' consisted of an elongated balloon, capable of lifting five tons, with an attached car containing a steam-engine actuating two screws by which the ship could be driven against the wind. As the weight of the car when fully loaded with fuel was 3½ tons, there was theoretically a surplus lifting power of 1½ tons available for passengers, etc. Bland's estimate of the possible speed was only 50 miles per hour, but he was sanguine enough to prognosticate the reduction of the passage between England and Australia to four or five days. In 1866 he announced his invention to the world in a broadsheet, but it attracted little notice, and his death in 1868 cancelled its last chance of being tried.

In 1878 Lawrence Hargrave (q.v.) began to study the movements of birds, fishes, and insects, and was impressed by the fact that fishes in diving turned aside and twisted their tails in a certain curve. Investigating still lower forms of animal life, he found in the worm three motions essential for flight—(1) starting and stopping while on a direct route, (2) turning to right or left, (3) rising vertically. He therefore constructed a large wooden model of a worm, and by means of radial wires attached to fixed points, recorded the curves along which these points travelled during the motion of the whole model. From these records, which showed the curves to be trochoids, he prepared an address on 'The Trochoided Plane,' and on 6 August 1884 delivered it before the Royal Society of New South Wales—the first public announcement of the possibility of achieving artificial flight. 'In its first stages' he said, 'the motion will be slow; and, as we gain confidence in the construction of the machine, we shall notice that by leaning our bodies in the direction we wish to go . . . . and reducing the speed of the planes, our object will be attained.' In 1885 he described to the Royal Society the flight of a plane built of paper and thin cane, with undulating wings, which when propelled by the contraction of rubber bands flew for 98 feet. In the following 15 years he read 19 more papers, illustrated by models.

In Australia little notice was taken of him or his discoveries. As late as 1898, when Langley in Canada was experimenting with planes, Hargrave told the Royal Society of New South Wales 'It appears regrettable that Australians should leave to Americans and others the tardy adoption of views circulated by this Society.' Among the few who recognized his genius was Richard Threlfall, then professor of physics at the university of Sydney, who said openly that Sydney would one day be famous 'not so much for its beautiful harbour as for the fact that it had been the home of Lawrence Hargrave, the inventor of human flight.' Outside Australia more attention was paid to him, and in 1900 Wilbur Wright asked permission to use his patents, only to be told by Hargrave that he took out no patents and wished the Wrights every success in applying his discoveries. These by that time covered the utilization of flat and curved horizontal planes, and straight vertical planes as used in the making of the box-kite that bears his name; in 1903 the Wrights, by applying these principles to larger box-kites, solved the problem of human flight.



A Hargrave Box-kite.

The Hargrave box-kite was also adopted, in 1906, by Santos Dumont for the first European flight, and in 1908 by the makers of the Voisin and Farman aeroplanes.

Hargrave also devised and constructed model engines, some with revolving cylinders carried on the propeller blades; from these were developed the engines of the Bleriot monoplane that first flew the English Channel, and the famous Gnome rotary engine.

Only in 1908 did Australia awake to the importance of aviation. In that year Farman in January flew nearly 1 mile in Paris. In March he flew 2½ miles. In May the brothers Wright in America, who five years previously had been the first in the air, flew 6 miles. In June Delagrange in Italy flew 10 miles; in July Farman flew 11 miles; in September the Wrights flew 56 miles, and in December 61 miles—the rapid increase in distance showing the remarkable development of aviation in a single year. In March 1909, after Zeppelin in Germany had cruised 150 miles, with 25 passengers, in his dirigible balloon, the world awoke to the possibilities of aviation for military purposes, and

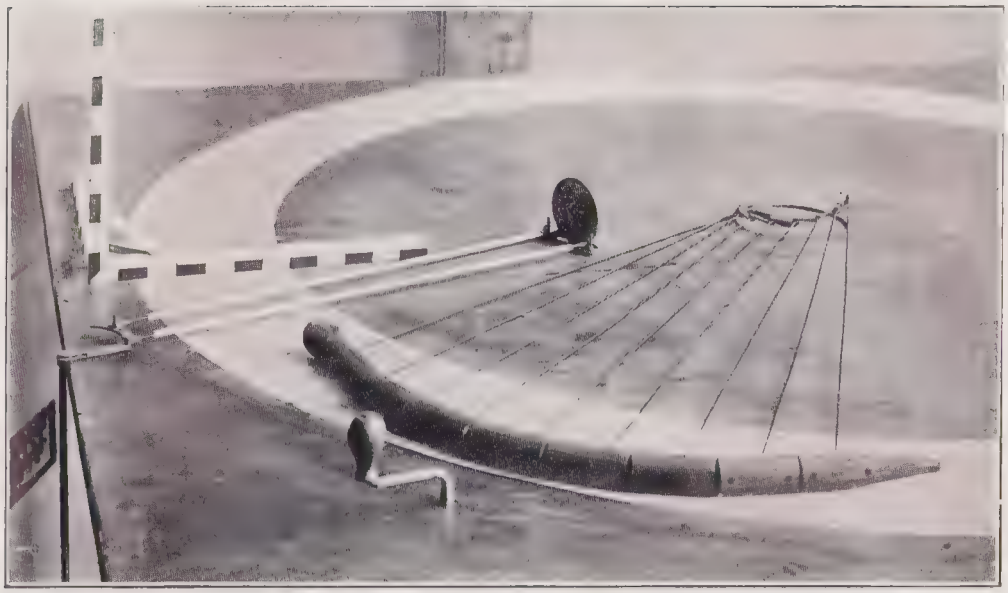
the greater nations began to hasten improvements in aerial machines. Australia joined in the general enthusiasm, particularly when it was pointed out that the successful aeroplanes were based upon Australian discoveries. To arouse the public to the importance of aviation for national defence in such a wide and undefended area, an Aerial League was formed in New South Wales on 28 April 1909, with branches in Victoria and Queensland. By means of public meetings the league secured the attention of the federal government, and a prize of £5000 was offered (provided that another £5000 was subscribed by the public) for the first Australian-made aeroplane that fulfilled certain conditions. When it was found that the public did not subscribe adequately, the federal government allowed its prize of £5000 to stand, and the military authorities were requested to draw up conditions; but as these stipulated that to win the prize an aeroplane must 'hover' no entries were forthcoming. The writer of this article (who had been one of the founders of the Aerial League) was, however, invited to join the intelligence corps of the Australian army, which comprised experts in many subjects of military value; and with the encouragement of the corps, and of the United Service Institution of New South Wales, interesting experiments in aviation and wireless were undertaken. One of particular value was the study by the writer of air resistance on curved planes, with the construction of a biplane 28 feet long and weighing 102lb., with planes 4 feet 6 inches wide which were curved in a degree that would enable flight against any wind over 10 miles an hour—the minimum force required for uplift. Experiments were carried out at Narrabeen beach, some miles north-east of Sydney, the writer thus being the first man in Australia to rise in the air on a free heavier-than-air apparatus. This was also the first occasion on which a motorless aeroplane was utilized for direct flight, a principle not taken seriously in Europe until 1922. The machine had a box-kite as tail balance, and steering was performed by the leaning of the operator from side to side; it was demonstrated that flying against the wind, turning and gliding back to above starting point, turning again to fly against the wind, and continuing in the air while the wind lasted, were all possible. Twenty-nine successful flights were made on 5 December 1909.

In the same month the first imported aeroplane reached Australia; this, a Wright machine, was exhibited in the various States, but no flights were undertaken. Early in 1910 H. Houdini brought a Voisin aeroplane to Australia, and made his first flight at Diggers' Rest in Victoria; successful flights were also made at Rosehill, near Sydney. About the same time a young experimenter, J. R. Duigan, constructed an aeroplane and machine near Mia Mia in Victoria, and on 16 July 1910 made a hop of 24 feet, and in September a flight of 100 yards. In the same year a Bleriot machine arrived in Australia, and a few short flights were made with it by Cuthbert of Adelaide. Early in 1911 arrived a Bristol aeroplane, which was flown by J. Hammond; one flight of particular interest was that from Mascot near Sydney to Liverpool, a distance of 18 miles, on 3 May. This machine was later transferred to W. E. Hart, who among other interesting flights made one of 30 miles from Penrith to the agricultural showground at Sydney. On 15 April 1912 Alban J. Roberts exhibited at Sydney an elongated balloon eight feet long, which was directed and controlled by wireless waves.

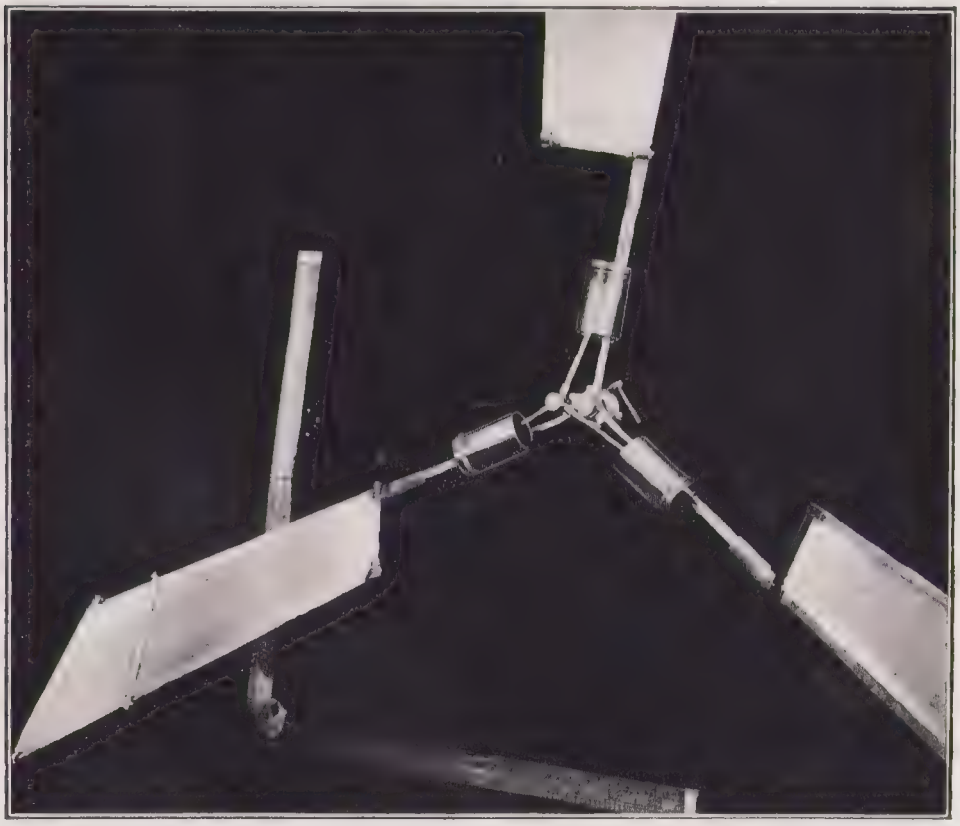
About this time an Australian airman, Harry G. Hawker, became prominent in English flying circles. Born in Victoria on 22 January 1889, he joined the Sopwith training school in England in 1912, and on 31 May 1913 established a height record of 11,450 feet, which in June he increased to 13,400 feet. In August of that year, during an attempt to fly completely round the British coasts, he covered 1043 miles in a seaplane in 55¾ hours. In the early months of 1914 he did some flying in Australia, but returned to England in June, and during the war acted as test pilot for the Sopwith firm, on 6 June 1915 achieving a height record of 18,339 feet. In May 1919 he attempted to cross the Atlantic from Newfoundland, but failed after flying over 1000 miles; on 16 July 1921 he was killed at Hendon while competing in the 'aerial Derby.'

During the war Australian work in aviation and air-plane construction was mainly carried on in Europe and at the various Eastern fronts. The record of flight achievements in Australian contingents has been chronicled in F. M. Cutlack's *Australian Flying Corps* (vol. viii of the Official War Histories); but several Australian airmen served in British corps and made names there. It is recorded, for instance, that Captain Brian Dowling, R.F.C., when piloting a machine over the German lines, had his steering gear and right wing shot away by anti-aircraft guns; the machine side-slipped and was about to crash when Dowling asked his observer to climb out on the left wing, then almost perpendicular, and his weight in this perilous position brought the machine back so near to normal level that Dowling was able to steer it back to the British lines. The history of the Australian Flying Corps may be summarized here very shortly. Its first section took part in the Baghdad expedition of 1915, and those who were not killed were made prisoners by the Turks in Kut; the first complete squadron served during 1916-8 in Egypt and Palestine; three other squadrons were trained in England and served on the western front in 1917-8. The four squadrons comprised 410 pilots, 153 observers and 40 other officers: of these 78 were killed, 68 wounded, and 33 taken prisoner. Of their machines 60 were destroyed by enemy action and 13 otherwise: on the other hand, they destroyed 276 enemy machines and drove down 251. On 31 January 1919 the number of flying officers was—wing commanders, 2; squadron commanders, 9; flight commanders, 27; junior flying officers, 386; under instruction, 52.

While demobilization was proceeding, the Commonwealth government offered a prize of £10,000 to the first Australian airman who made the flight from England to Australia within 30 days. Six parties made the attempt, but only two got through. The prize-winning flight, that of Ross and Keith Smith, is described under Smith, Sir Ross. A second party—Lieutenants R. J. P. Parer and J. C. McIntosh—completed the flight after long delays: they started from England on 8 January 1920 but reached Port Darwin only on 2 August, mainly because (as they had been warned before starting) the engine-power of their air-plane was inadequate. As a feat of courage and endurance their flight is notable, but its value to students of international aeronautics was limited. A third flight from Europe to Australia, undertaken in April-

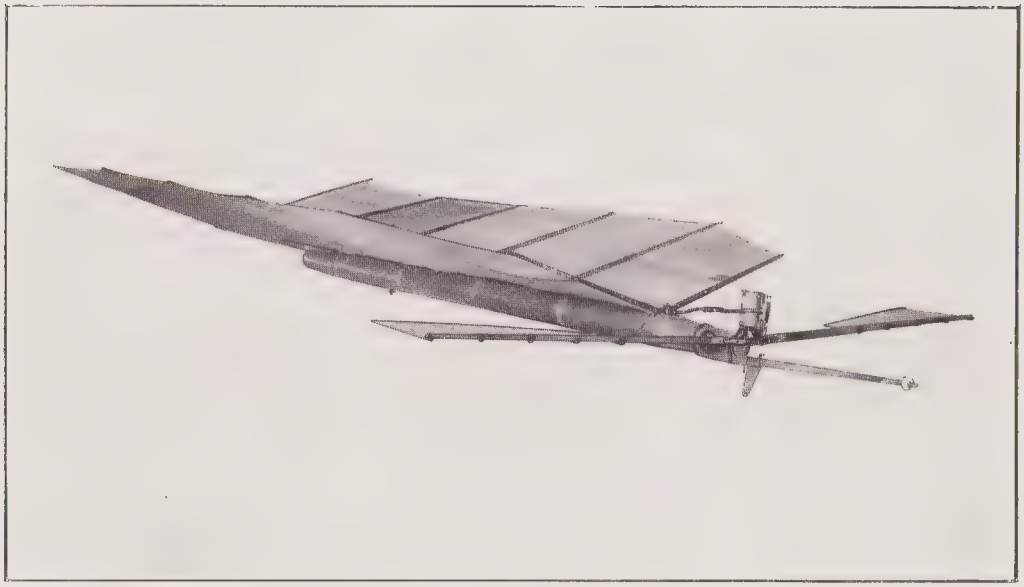


HARGRAVE'S WORM MODEL

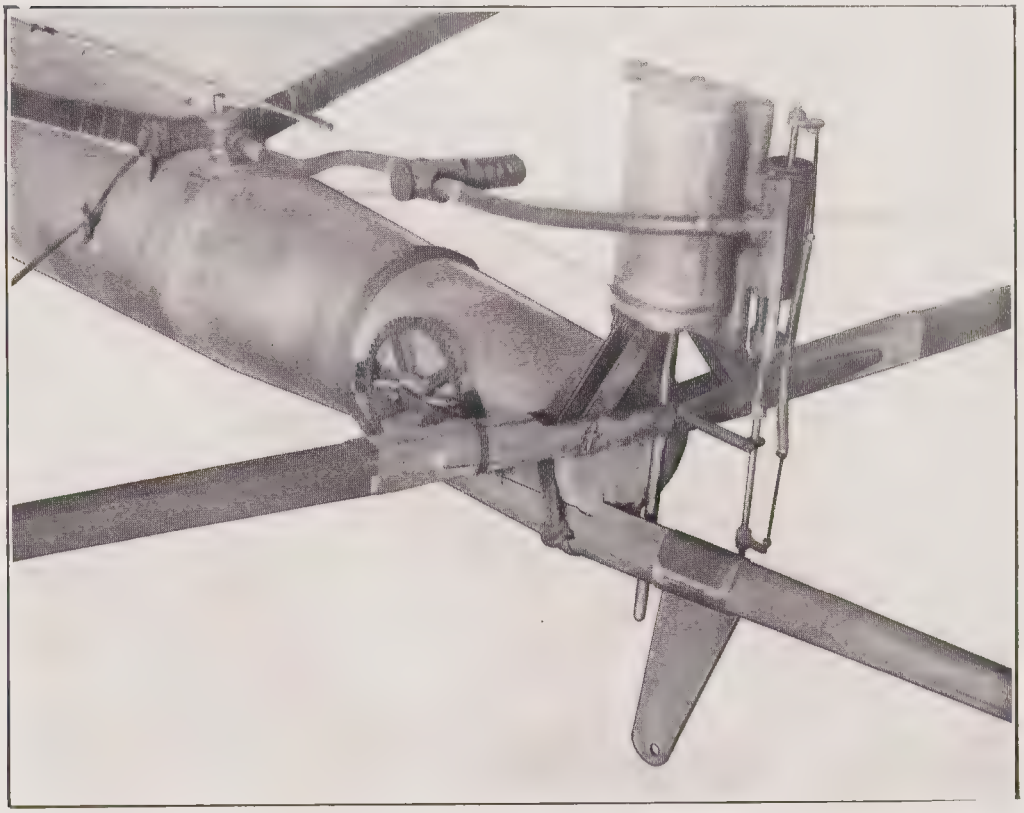


HARGRAVE'S ROTARY AEROPLANE ENGINE (1889)

Plate VIII



HARGRAVE MONOPLANE MODEL DRIVEN BY COMPRESSED AIR, 1890.
This model flew 343 feet.



SINGLE-CYLINDER, COMPRESSED-AIR ENGINE WHICH DROVE THE 1890 MODEL
One-third natural size.

May 1925 by an Italian airman, Major Francesco de Pinedo, used several deviations from the earlier route. Starting from Brindisi on 27 April de Pinedo flew by Leros in the Aegean Sea to Baghdad, thence to Basra, Karachi, and Bombay by the usual airway; crossing India direct to Cocanada in the Godavery delta, he visited Calcutta, Akyab, Rangoon and Penang on the way to Singapore, and made thence by Batavia, Bima in Sumbawa, and Kupang in Timor, to Broome in Western Australia. The total distance, about 10,500 miles, was covered in 35 days from Brindisi.

With the advent of peace in 1919 and the return of Australian airmen to their own country, aviation came slowly into use for the transport of mails, goods and passengers across the vast Australian continent. In December 1920 an air navigation act was passed and a civil aviation department established under Lieutenant-colonel H. C. Brinsmead as controller. The first aerial route (1200 miles) was established on 6 April 1922 between Derby and Geraldton in Western Australia; it was extended to Perth in 1924, and weekly mails, and passengers, are now carried with regularity. The route is subsidized to the extent of £30,000 per annum. On 2 November 1922 a route was established from Charleville in western Queensland to Cloncurry (560 miles), with a subsidy of £12,000; this route was extended in February 1925 to Camooweal on the border, 248 miles farther away. Aerial services between Adelaide and Sydney and between Sydney and Brisbane were contracted for in 1921. The Adelaide-Sydney service was started on 2 June 1924; but in the early months of 1925 it was decided to abandon this service and substitute services from Adelaide to Cootamundra *via* Mildura and Hay, with branches from Mildura to Broken Hill and from Hay to Melbourne. The subsidy is 4d. per mile flown. On the routes in operation at the end of 1924 there are 59 landing-grounds, and 28 more have been provided elsewhere. Routes have been surveyed from Melbourne to Perth, from Adelaide to Port Lincoln, from Melbourne to Hay, and from Derby to Wyndham, but on these routes no landing-grounds exist as yet. A military route has been surveyed from Cloncurry in Queensland to Port Darwin. Contemplated, but not yet surveyed, routes include those from Oodnadatta in South Australia to Alice Springs in the Northern Territory, from Brisbane to Charleville, and from Townsville in northern Queensland to Rabaul in New Britain. Up to the end of September 1924 the figures for the three existing services were as follows:—flights 3414, miles flown 494,978, passengers carried 2741, letters carried (to end of August) 349,153, freight carried 20,076 lb. Postage rates on all services are 3d. per half-ounce in addition to ordinary postage.

In April-May 1924 Wing-commander Goble and Flying-officer McIntyre in a three-year-old Airey seaplane flew round the whole of the Australian coast, covering 8568 miles in 44 days (90 flying hours). Their object was to make a rapid survey of the coast in order to select the best sites for coast-defence air-stations: they had no prepared aerodromes or repair bases, and no information about local conditions, meteorological or other, except what they could pick up on the way. It was one of the finest flights in the history of aviation, and the Royal Aero Club in 1925 awarded to its achievers the Britannia challenge trophy for the best flight of 1924.

G.A.T.

Avocets. See WADERS.

Axe-breaker, See NOTELAEA.

Ayers, SIR HENRY (1821-1897), born at Portsea in England on 1 May 1821, and trained for the law, in 1840 migrated to South Australia to follow his profession, but in 1845 became secretary of a company formed to work the Burra Burra copper mines. In March 1857 he was elected to the legislative council. For 11 days in July 1863 he was a member of the Dutton ministry, and upon its resignation formed his own first cabinet, which lasted (with a few internal changes) until August 1864; he then became chief secretary in the first Blyth ministry, held the same portfolio in the second Dutton ministry, and in September 1865 once more took the premiership, but held office for only a month. Between 1867 and 1873 he was premier and chief secretary in four other ministries, and chief secretary in the Colton administration from June 1876 to October 1877. In June 1881 he was elected president of the legislative council, and held that position until his retirement in 1893. While he was premier in 1872, the overland telegraph line was opened for traffic. For 40 years he was a trustee of the Savings Bank of South Australia, and for many years chairman of the board. For 35 years he was governor of the Botanic Gardens board. He was also first president of the Old Colonists' Association, and treasurer of the university council. As an administrator and organizer his reputation stands high; his strong prejudices against borrowing often restricted the extension of the national debt, and to his foresight, penetration and commercial courage many flourishing businesses owe their success. As a representative of South Australia at intercolonial conferences he was a prominent figure. In 1863 he represented the State for the consideration of uniform tariffs and custom duties, and their distribution, in 1864 for the conference in Melbourne dealing with the transportation of criminals from the United Kingdom; in 1867 for the meeting of delegates in Melbourne to consider the ocean postal question; and in 1873 and 1877 he was again chosen to represent South Australia in intercolonial conferences in Sydney. He died on 11 June 1897. (C.M.G., 1870; K.C.M.G., 1872; G.C.M.G., 1894.)

B

Babblers, (*a*) a general term used for the Timaliidae. The typical genus, *Timalia*, is found in the Malay islands, one species reaching Bengal. Some other forms that are commonly included in the Timaliidae may be related to *Timalia*, but the 'family' with the limits usually assigned to it has long been recognized as artificial; Sharpe calls it 'the rubbish heap,' and a German distich runs:—

Was man nicht unterbringen kann,
Sieht man als Timeliden an.

(Birds that cannot be otherwise classified are considered to be Timaliidae).

Among Australian birds still allotted to it by some authorities are the coachwhip-birds, field-

Australian Babbler.

wrens, ground-wrens, ground-birds, log-runners, pilot-birds, scrub-robins and song-larks, all of which are separately dealt with.

(*b*) In Australia the name is restricted to birds of the genus *Pomatostomus*, belonging to the family Crateropodidae distributed throughout tropical Asia, the Malay Archipelago and Australia. This family contains a portion of the birds formerly grouped as Timaliidae, characterized by their stout, somewhat curved bills and strong legs and feet. Four species of *Pomatostomus* occur in Australia, none of them extending to Tasmania. The commonest in south-eastern Australia is the Australian Babbler (*P. temporalis*); the most widely distributed is the White-browed Babbler (*P. superciliosus*), found throughout the continent.

In habits all the species resemble one another. They are about the size of thrushes. In coloration they are brown above and white on the underparts, with white eyebrows and white tips to the tail-feathers. They are sociable, live in small parties, and are generally found in open forest country inland; they are noisy and garrulous, commonly feeding on the ground; when alarmed they take to the trees, which they ascend one after another in a series of hops, at intervals stopping to peer down and utter their chattering call.

Their nests are large and solidly built structures of twigs, with a passage-like entrance at one side, placed a few feet from the ground in a bush or small tree. A large number of nests are constructed, but only a few appear to be completed with the lining of grasses; the rest are apparently abandoned. The four eggs are light brown or greyish, blotched with purple and brown, and streaked with fine black lines.

Backhaus, Henry (1811-1882), born at Paderborn in Westphalia, was trained at Propaganda, Rome, where he was ordained priest in 1836. For some years he served as chaplain to the French troops in India, and came later to Adelaide. At the close of 1851 gold was discovered at Bendigo, and people flocked there from all parts of Australia. Father Backhaus determined to accompany his flock, and in 1852 celebrated Mass for the miners in a calico tent at Bendigo, which he soon replaced by a large church dedicated to St. Kilian. In laying the foundations for his own residence a rich gold deposit was discovered, for which he was offered £10,000. Wealth poured in upon him from the opulent gold-miners, and on his return to Germany it was said that he was wealthy enough to purchase a principality. At his death in September 1882 he bequeathed his property, valued at £250,000, to religious purposes in the Bendigo diocese.

E.M.O'B.

Backhouse, James (1794-1869), born at Darlington in England on 8 July 1794, studied botany and its practical applications in English and Scottish nurseries, and in 1822 bought the old nursery of the Telfords at York. He also about that time became a leading member of the Society of Friends. For some years he felt a strong call to visit the Australasian colonies; this seems to have been a purely personal impulse, though before leaving England he obtained credentials and letters signed by the congregation of Friends at York to which he belonged. On 3 September 1831 he and George Washington Walker (q.v) sailed from London on the first religious mission undertaken by Quakers in Australasia. They reached Hobart on 8 February 1832, and at once entered on their work, holding meetings and putting tracts and religious books into circulation. Colonel Arthur gave them every facility for their undertaking, and during the next three years they systematically visited every gaol, convict settlement and chain-gang in the island. It does not appear that their ministrations had any great or lasting effect at Macquarie Harbour or Port Arthur, or among the chain-gangs, but their genuine piety and love of humanity won them respect and a hearing everywhere. In April 1832 they took part in the founding, at Hobart, of the island's first temperance society, a thing much needed in a community where hard drinking was almost universal. Mostly on foot, with a Bible in one hand and a pocket compass in the other, they traversed almost all the settled districts from Pittwater to Circular Head and from Oyster Bay to Macquarie Plains,

and visited the remnant of the Tasmanian aborigines on Flinders Island. From Hobart they went to Sydney, and spent two years in similar work in New South Wales, visiting not only the settled districts of the colony but the 'ocean hell' of Norfolk Island and the penal settlement at Moreton Bay. Their subsequent reports on the convict system helped to promote reforms in penal methods and to improve the lot of the prisoners. They also supplied the government at Sydney with suggestions for the better care and treatment of the aborigines, as well as a report of a general nature, in which, amongst other things, they deprecated the licensing of breweries and distilleries. They returned to Tasmania in 1837 and seven months later went to Melbourne, from which infant settlement they passed on to South Australia and Western Australia. From Fremantle they sailed on 12 February 1838, for the Mauritius, and after a short stay there went to the Cape Colony, where they visited remote districts in the course of their work. Backhouse found time during his tour to make large botanical collections in Australia and Norfolk Island. In February 1841 Backhouse returned to England, and told the story of their nine years' work and wanderings in his *Narrative of a Visit to the Australian Colonies* (1843) and *Narrative of a Visit to Mauritius and South Africa* (1844). Walker returned to settle in Hobart but Backhouse devoted himself to missionary work in Great Britain, and died at York on 20 January 1869.

While there were already Quaker families (e.g. the Cottons) settled in Tasmania when Backhouse and Walker arrived, it is perhaps due to their influence—especially to that of Walker—that the Society of Friends finds in Tasmania its chief centre in Australasia.

Backhousia, a genus of the family Myrtaceae, chiefly found in eastern Australia, consisting of trees or shrubs with opposite feather-veined leaves. The calyx-tube is broadly bell-shaped, with petal-like lobes; petals 4, shorter than the calyx-lobes; stamens in several series; capsule enclosed in the calyx-tube, the seeds falling with the fruit. *B. citriodora* yields a lemon-scented oil like that extracted from the Lemon-scented Verbena (*Lippia citriodora*), whose perfume is used for scenting soaps. It has a fine, hard-grained timber used for ornamental work. *B. myrtifolia* (Scrub Myrtle) is an ornamental shrub or small tree with showy white flowers, having a tough, durable timber suitable for turnery. The genus is named after James Backhouse (q.v.).

Bacteriology, Economic. A purely Australian microbe has not yet been found, nor is it probable that one will be; several have been first discovered here, but all have afterwards been found in other countries. The microbe that produces gummosis of the sugar-cane is a case in point. In this disease the plants affected show symptoms of decay, and, when cut across, exude from the cut ends of the fibrillar strings a yellow gummy mass. Microscopic examination shows that the large rounded vessels of the vascular bundles are filled with gum, which by plugging up the vessels prevents the transmission of nourishment through the plant; if the main tubular vessels are choked, the whole plant is affected, otherwise only a part of it suffers. N. A. Cobb, who discovered that the gum always contains microbes (which he named *Bacillus vascularum*), was of the opinion that the microbes produced the gum. The truth of this is now undoubted, and the writer of this article has grown the microbe and produced the gum in his laboratory on a jelly containing sugar-cane juice. The artificial gum had all the properties of the natural gum, and was, in fact, identical with it. Further, E. F. Smith in America has, by inoculation with pure microbes isolated from diseased cane, reproduced the disease in healthy plants.

The production of gum by bacteria inhabiting the tissues of plants is of common occurrence in Australia. Wattle gum, for instance, is of two kinds; one is soluble in water and adhesive like gum acacia, the other simply swells when soaked in water. The latter consists of metarabin or cerasin, is found exuding from the trees in cold climates, and is generally known as cherry-tree gum. The irregular occurrence of gum on our wattles (for only some trees are gum-bearers, and only some branches even on those trees) led to the discovery that in the bark of gum-bearing branches certain bacteria, *B. acaciae* and *B. metarabinum*, live upon the sugar in the sap and convert it into gum; the former produce arabin, the latter metarabin. A tree at Mittagong in New South Wales furnished the original bacteria, and with them slimes were grown on plates of agar-jelly containing sugar. When heated under pressure the slimes were decomposed into (*a*) coagulated proteid and (*b*) a solution of gum which was adhesive, had all the chemical properties, and furnished all the decomposition products, of gum acacia. The second microbe (*B. metarabinum*), similarly cultivated, gave a tough slime like cherry-tree gum, which liquefied under steam pressure and again reverted to the insoluble condition when treated with alcohol. These two bacteria were shown to be the same when *B. acaciae* was inoculated into a peach-tree, and in course of time gum of the insoluble kind exuded. In the bark were found *B. acaciae*, *B. metarabinum*, and all stages between the two. Evidently the host-plant has the power of altering the physiological activity of the bacterium: and this is why certain species of wattle uniformly produce a certain kind of gum. Some trees always produce soluble, some insoluble gum, and some a mixture of the two. The character of the gum will also depend on the climate, for rain or dew will dissolve and wash away the soluble gum.

The gum of the kurrajong tree (*Sterculia diversifolia*) differs from wattle gum in certain characters; a bacterium from the bark, isolated and cultivated in the laboratory, produced a gum which proved to be pararabin—that obtained from the tree.

Living in conjunction with *B. acaciae* in the bark of such gum-bearing trees as the peach, almond and cedar, another bacterium was found, which elaborated a soluble gum that became insoluble on drying. This bacterium differs from those previously obtained in being a comparatively large spore-bearing rod.

Plants of the family Leguminosae have their roots studded with nodules containing myriads of dead and many living bacteria, *Rhizobium leguminosarum*. The gaseous fixation of atmospheric nitrogen, which is common to all leguminous plants, is associated with the growth of these nodules; and the writer has suggested that the bacteria utilize the saccharine matter of the plant to elaborate a nitrogenous slime, which in its turn causes the localized growth of the nodule. The production of slime appears to bear some relation to the fixation of atmospheric nitrogen, for laboratory cultures showed that the weight of

slime formed by the microbe was proportional to the weight of nitrogen gained from the air. Australia is the home of the acacia, and our soils should be rich in these nitrogen-gathering bacteria—as indeed investigation has shown. A good alluvial soil from the Hawkesbury Agricultural College contained over 11,000,000 bacteria per gram; and it was brought out during the investigation that the fertility of a soil is roughly proportioned to the number of rhizobia it contains.

The occurrence of ropiness or viscosity in industrial processes is fairly common. Country bakers are often troubled with ropy bread, the result of the activity of *B. vulgatus*. Milk, beer, wine, cider, vegetable infusions and ink all have their ropy or slimy diseases. Tanners sometimes find their liquors thus affected. In the winning of sugar viscosity is a serious fault, preventing crystallization; as the gum is formed at the expense of the sugar, the loss from both causes may be great. The gum-fermentation of cane-sugar juice is caused by *B. levaniformans*, allied to the potato bacillus (*B. vulgatus*). *B. levaniformans* feeds upon cane-sugar, changing it to gum levan, to invert sugar (a mixture of levulose and dextrose) and to certain acids. In cane-sugar juice the gum-fermentation is the pronounced phenomenon, for the viscosity is more apparent than the inversion of the sugar; but the bacillus is also to be found in the sugar-crystals, which it slowly alters, especially if they should become moist. It is also found in beet-sugar, in the soil and in the tissues of the plant—and the resulting loss is considerable in all parts of the world.

Milk is particularly prone to ropy fermentation. Some active slime-producers have large, swollen capsules, which by their mass constitute the trouble; other bacteria attack the lactose, and a few the casein. The 'jellification' of condensed milk has been investigated in Australia, and the active organism found to be an ally of *M. albus* which, while capable of producing the disease by itself, is ably assisted by salts of lime. In this case it is the casein, not the lactose or saccharose, that is 'jellified.' Another instance of the production of slime from proteid matter is found in the household bath-sponge, the proteid skeleton of which is, by the action of several micro-organisms, converted into a mass of useless slime. The most active of these organisms resembles in appearance the *Rhizobium* of leguminous nodules.

The ropiness of wattle-bark tan-liquors has been shown to be caused by at least two organisms, which alter the non-tannins (sugar) into a ropy slime. These bacteria are very sensitive to the action of certain salts; for example, a solution of three parts of sodium acetate in 10,000 parts of tan-liquor prevents their growth.

Waste bark from tanneries is utilized by the white lead manufacturer to corrode his lead. After a preliminary treatment, known as tempering, the moist tan bark is spread in a layer upon which is placed a number of earthenware pots containing dilute acetic acid below a number of sheets of perforated lead. A roofing of timber is laid over the pots. Then more bark is spread as a bed for more pots and thus a stack of some twenty tiers is built up. The bark begins to heat or ferment and during the fermentation, great quantities of carbon dioxide gas are given off. The combination of heat, acetic acid and carbon dioxide attacks the metallic lead converting it largely into basic carbonate of lead which, after being ground with water and incorporated with oil, becomes white lead pigment, the basis of many oil paints. During the fermentation of the bark, the temperature of the stack rises to 80°C. and the active agent is a bacterium which acts and thrives at this comparatively high temperature. It is a spore-bearing rod and the spores are very resistant to heat, being able to survive a dry temperature of 200° C. at which cotton wool is charred.

The action of disinfectants in improving the fertility of the soil is, according to Russell and Hutchinson, due to the fact that they destroy certain protozoa; when these are eliminated, there is a marked increase in the number of bacteria on which they would have fed, and which by breaking down the organic constituents of the soil render its nutritious elements more soluble. It had been previously noted, in experiments intended to eliminate soil-pests like phylloxera and nematodes, that the treatment not only destroyed the pests but actually augmented the yield of the crops.

Heat has much the same effect as disinfectants in increasing the fertility of soils, though possibly the method of action may be different; moreover, while a moderate heat is beneficial, a temperature of 135° to 150° C. brings about the production of certain soluble poisonous substances, which render the soil toxic to plants. It is difficult to judge the precise effect of bush-fires on the soil, but on the whole it is probably beneficial. The most apparent action of volatile disinfectants, or of a moderate heat, is to disturb the natural balance of the soil bacteria. The great bulk of the bacteria and (according to the moisture content) the bulk of the protozoa are destroyed, while the hardy spore-forming bacteria are left, and in time become exceedingly numerous—though the survival of some of the bacteria-destroying protozoa and other conditions tend to check increase beyond a certain level, and the number of bacteria in any particular soil may be considered stationary.

One reason for the maintenance of this bacterial level may be the retarding influence of the by-products or toxins of the bacteria themselves. These toxins are destroyed by a moderate heat and by sunlight, and, being soluble in water, are naturally washed out of the soil by rain. It is not always possible to obtain evidence of their toxic action. In the neighbourhood of Sydney they were found in winter, but never in summer, and generally after a short spell of cool, dry weather. They were capable of destroying a test bacterium; but, when a mixture of soil bacteria was introduced, they delayed or hindered the growth without destroying it. Heating the toxic extract to 94° or 100° C. caused the destruction of the toxin; the extract then became nutritive, and favoured a rapid growth of bacteria. Another reason may be found in the action of the volatile disinfectants as fat solvents. The fatty matter of the soil—the remnant of the ether-soluble matter of plant residues—is, presumably, impregnating the organic matter. It is dissolved by the disinfectant, and re-deposited, not upon the particles originally containing it, but upon all the particles of the soil. Thus the organic matter is less protected against bacterial attack, and also against the solvent action of the soil-water, so that it becomes fermentable and will support a more numerous population. To prove this hypothesis a column of soil was treated with chloroform and, after dispersal of the disinfectant, extracts were made from the layers of the column. The

extracts made from the lower layers always grew more bacteria than those from the upper layers, into which the fatty matter had been carried by the evaporating disinfectant. The matter is therefore complex, and controversies have arisen from attempts to explain the facts by one hypothesis.

Through the munificence of the late Sir William Macleay, the laboratory of the Linnean Society of New South Wales has become the Australian home of research in economic bacteriology. The details of the researches mentioned in this review will be found in the pages of the *Proceedings* of the Linnean Society of New South Wales. Certain State departments of agriculture also prepare and send out cultures of lactic bacteria for butter factories, and of nitrogen-fixing bacteria for agriculturists. R.G.S.

Badham, CHARLES (1813-1884), born at Ludlow in Shropshire on 18 July 1813, was a son of Charles Badham, M.D., F.R.S., regius professor of physic at Glasgow, and of Margaret Campbell, first cousin of the poet Thomas Campbell. Lewis Campbell, editor of Sophocles and Plato and professor of Greek at St. Andrews, was Charles Badham's cousin. The boy got his first schooling from Pestalozzi ('I was his favourite pupil' wrote Badham in 1876): thence he went to Eton and Oxford (B.A., 1836; M.A., Cant., 1846; D.D., Cant., 1852). His B.A. degree carried third-class honours only; Dr. Woolley, his predecessor at Sydney, gained first-class honours the same year. There followed seven fruitful years of Continental travel during which Badham ransacked libraries for Greek MSS, absorbed the languages and literatures of the major civilized nations, and—as the recognized heir of Porson, Elmsley, and Dobree, who taught Europe Greek from 1797 to 1825—made life-long friendships with the greatest classical scholars of the Continent. Cobet of Leyden was his dearest friend. Returning to England in 1846, he took orders with a view to scholastic work. The England of that time was capable of appointing Benjamin Jowett regius professor of Greek at Oxford and then withholding his stipend on account of his heretical views. Badham, though prized at home by many of the finest minds—Thackeray, F. D. Maurice, Lord Lyttelton, Thompson of Trinity—and fully recognized abroad (Leyden gave him its honorary D.Litt. in 1860 and its S.T.P. in 1864) could get nothing better than the headmastership of a proprietary school at Edgbaston near Birmingham—'in the land of the Chalybes,' as he puts it—but he had Newman as a neighbour. And then 'the one English scholar of the mid-century whose reputation crossed the Channel received from abroad the praises of his peers, but at home was excluded from academical preferment, set to teach boys at Birmingham, and finally transported to the antipodes,' says Professor A. E. Housman. That transportation was our great good fortune. As professor of classics and logic at Sydney from 1867 to the day of his death, he strove hard, in word and act, for a true and vital idea of education. His own private work was along the arduous and subtle lines of textual criticism, and in what used to be regarded as the 'higher mathematics' of that art—Plato's *Laws*: but as teacher, as orator, as man, he was the first and only 'democratizer' of the university. He it was who offered himself, free of cost, as private tutor to working-class students all over the colony; who stumped the country to found bursaries; who secured the establishment of evening lectures. It was fitting that his body should be borne to the grave by the bursars of that time, and that they should set over him the simple memorial which, as his widow says, was the only thing he would have desired. And when, from the official point of view, the professor of classics and logic was the only professor in the faculty of arts, he—being Charles Badham—was professor of ancient and modern, of universal and comparative literature. His published work comprises editions of the *Helena, Ion* and *Iphigeneia in Tauris* of Euripides; the *Euthydemus, Laches, Phaedrus, Philebus* and *Symposium* of Plato; an *Adhortatio* to Sydney undergraduates; and a posthumous volume of speeches and lectures delivered in Australia. But this very inadequately represents the learning and the genius of a man whom Grote describes as 'the greatest of living scholars,' Newman as 'the first Greek scholar of the day,' and the *Quarterly Review* as one who 'could impart instruction to the ripest scholars of the age.' He died on 26 February 1884 in the university building, which was his house and home. In January 1921 his widow enriched the university library with the gift of his classical books. C.B.

Baeckea, a genus of the family Myrtaceae, consisting of heath-like shrubs chiefly found in Australia, though a few species extend to New Caledonia, Malaysia, and south China. The flowers are white or pink, solitary or several together; calyx-lobes 5, often scarious; petals 5, usually rounded; capsule, enclosed in the calyx-tube, opening at the top in 2-3 valves; leaves small, opposite and entire. *B. virgata* is a tall graceful shrub, with flat leaves and flowers exceptionally large for the genus. *B. linifolia,* a tall, graceful shrub with fine cylindrical leaves and a profusion of white flowers clothing the slender, drooping branches, is usually found on the banks of watercourses.

Bagot, CHARLES HARVEY (1788-1880), born in Ireland in 1788 and trained for the army, served with distinction in the East Indies and had attained the rank of captain before he left the service. In 1840 he migrated to South Australia and took up land for a sheep-run at Kapunda. On this property copper was discovered in 1842, at first by Bagot's young son, then by Francis Dutton his overseer; Bagot and Dutton quietly bought 80 acres of the mineralized area, made a track to Port Adelaide (42 miles away) and opened up the famous Kapunda mine. In 1843 Bagot was nominated to the first legislative council, and sat in the council of 1851-6 (as member for Light) and in the first legislative council under responsible government; he was also in the council in 1865-9. As a politician his chief distinction was that he opposed Governor Robe both in his policy of state aid to religion and in his attempts to impose a royalty on minerals. He was above all things a pastoralist and stock-breeder, and made this the occupation of a long life, dying in Adelaide on 29 July 1880. His sons Christopher and Edward also occupied themselves with pastoral pursuits; but a grandson, JOHN BAGOT (1850-1910), son of Christopher, after spending many years in developing property in the Macdonnell ranges (where he was the first white man to greet John Forrest after his adventurous journey in 1874 across Western Australia), was persuaded by Josiah Symon to enter politics, and

in 1884 defeated a minister at the elections for the district of Victoria (the south-eastern region of the colony).

From a distinct Irish family came JOHN TUTHILL BAGOT (1818-1870), who in 1857-65 represented Light in the South Australian assembly, and was solicitor-general in the short-lived Baker ministry of 1857, commissioner of crown lands in the first Reynolds ministry (1860-1), and—having been elected to the legislative council in 1866—attorney-general in the second Hart ministry (1868) and chief secretary in the first Strangways ministry (1868-70). He died on 16 August 1870.

Bailey, FREDERICK MANSON (1827-1915), was the best-known of a family of botanists closely associated with practical work in Australia. His father, JOHN BAILEY (1800-1864), born at Hackney, London, was trained in the botanical nursery of Conrad Loddiges, then the most extensive in England, and in 1838 migrated to South Australia, taking with him a large number of vines, olives and other fruit-trees. On his arrival in March 1839 Gawler made him colonial botanist at a salary of £80 per annum, but Grey's retrenchments included this post, and Bailey established a private nursery, through which he introduced many valuable plants into the colony. He died in 1864.

F. M. Bailey was born at Hackney on 8 March 1827, and arrived in South Australia with his father in 1839. Taking up orchard-work, he migrated in 1853 to New Zealand, and to Queensland in 1861. In 1875 he was made botanist to a board appointed to deal with plant and animal diseases; later on he was in charge of the botanical section of the Queensland museum, and in 1881 was appointed colonial botanist. He was an indefatigable collector and author, and a fellow of the Linnean Society. Much of his work is summarized in three important publications—*The Queensland Flora* (6 vols., 1899-1902), *Weeds and Suspected Poison Plants of Queensland* (1906), and *The Comprehensive Catalogue of Queensland Plants, both Indigenous and Naturalized* (1912). Between 1874, when he privately issued his *Handbook to the Ferns of Queensland,* and 1915, when his latest *Contributions to the Flora of Queensland* appeared, he also wrote numerous botanical papers, and added a large number of species to the flora of Queensland. He died in Brisbane on 25 June 1915. (C.M.G., 1911.)

His son, JOHN FREDERICK BAILEY, born at Brisbane in 1866, was in 1889 appointed assistant to his father, in 1905 made director of the Brisbane botanic gardens, and in 1915 colonial botanist. In 1917 he resigned this post to become director of the Adelaide botanic garden. In Queensland he devoted much time to the investigation of the timbers of the State's tropical region.

Baker, JOHN (1813-1872), born at Ilminster in Somerset on 28 December 1813, migrated to Tasmania while still a young man. In 1838 he visited Adelaide, then newly settled; imported 10,000 sheep from Tasmania, under an arrangement with the South Australian Company; and, settling in 1839 permanently in South Australia, took up pastoral pursuits, bred and trained thoroughbred horses, and formed a company for the importation of draught horses. In 1850 he helped to found the Adelaide chamber of commerce (of which he was the first chairman), and in 1851 helped to establish the botanic garden, and was three times president of the Horticultural Society. He represented Mount Barker in the mixed legislative council from 1851 to 1856, and in 1857 was elected a member of the new council, holding the premiership of the colony for 11 days in August of that year. The seat in the council he held continuously until his death at Morialta in South Australia on 18 May 1872.

Baker, SIR RICHARD CHAFFEY (1842-1911), eldest son of John Baker (q.v.), was born at North Adelaide on 22 June 1842, educated at Eton and Cambridge (B.A., 1864; M.A., 1870), and called to the English bar at Lincoln's Inn in 1864. Returning next year to South Australia, he took up politics, and in 1868 entered the house of assembly as member for Barossa, becoming attorney-general in the Hart ministry from May 1870 to July 1871. Between 1871 and 1877 he practised his profession privately, but in the latter year was elected to the legislative council and held the seat till 1901, being president of the council from 1893 onwards. In June 1884 he took the ministry of justice and education in the Colton cabinet, retiring in June 1885 to represent the Australian colonies in London during negotiations for a renewal of the expiring mail contracts with Great Britain; in this connection he obtained important concessions. In March 1891 he was appointed one of the South Australian representatives to the federal convention, distinguishing himself as a champion of the smaller colonies. He was elected in 1897 as one of the ten representatives of his colony to the federal convention of 1897-8, which framed the present Commonwealth constitution, and became vice-president of that convention and chairman of committees. It was natural that, when South Australia chose its ten senators for the first federal parliament, Baker should be one of them; and when the senate met to choose a president he—having as aforesaid been president of the South Australian council—was the obvious choice. This post he held till the end of 1906, when he resigned his seat in the senate and retired into private life. He represented the Commonwealth at the Delhi Durbar of 1903. He died on 18 March 1911. He was the author of several pamphlets on constitutional subjects, and of a manual of authorities for the use of the 1891 convention. (C.M.G., 1886; K.C.M.G., 1895).

Balcombe, WILLIAM (1779-1829), entered the British navy early in life, but in 1807 is found at St. Helena in the employ of the East India Company as superintendent of public sales; he had also a share in a business for purveying stores to ships that touched at the island. When Napoleon arrived at St. Helena in October 1815, Longwood not being ready for him, he stayed for nearly two months in a pavilion attached to Balcombe's house, The Briars, and became very friendly with the family. When Napoleon removed to Longwood, Balcombe became purveyor to his household, and friendly visits were frequent; but Sir Hudson Lowe found occasion to believe that Balcombe was transmitting the prisoner's letters to Europe clandestinely and negotiating bills for him. Consequently in March 1818 the Balcombes left for England, and for the next five years lived in Devon. In 1823, however, Lowe and Balcombe were reconciled, and almost immediately afterwards Earl Bathurst appointed Balcombe colonial treasurer in New South Wales. It is likely that by 1823 Lowe had discovered his suspicions to be unjust; at any rate the appointment was avowedly a partial compen-

sation for the heavy losses Balcombe had incurred in the government service at St. Helena. His career as treasurer was in the main uneventful, though in 1826 he came into collision with Darling and Macleay over the affairs of the Bank of New South Wales, then badly managed and in serious difficulties. Balcombe was charged by Darling with having paid public moneys into the bank at a time when he should have known it was unsafe; but Bathurst, while agreeing that he had done wrong, merely ordered that in future the public funds should be equally divided between the two existing banks. Balcombe died on 19 March 1829.

His second son, THOMAS TYRWHITT BALCOMBE (1810-1861), became a locally notable artist; he made a portrait of E. H. Hargraves, and in 1852 illustrated the *Gold Pen and Pencil Sketches* of G. F. Pickering.

Ballot, VOTING BY. This system of voting was advocated in England as far back as 1780, and was the subject of many bills introduced in the British parliament from 1830 onwards (and invariably rejected by the house of lords); but the methods of balloting most commonly used nowadays are of Australian origin, and the first ballot law ever passed was that of Victoria on 19 March 1856. The honour of approving and introducing the system is keenly disputed between Victoria and South Australia.

Under the act of 1850 'for the better government of Her Majesty's Australian colonies' both South Australia and the Port Phillip district of New South Wales (the latter shortly to become the colony of Victoria) were given elected legislative councils, the machinery of which was to be provided by the already existing councils of South Australia (then purely nominee) and New South Wales (already partly elected). Agitation sprang up at once in Adelaide and Melbourne for the inclusion of the ballot in this machinery. The South Australian council, bombarded with petitions, disregarded them and in February 1851 passed an electoral act which insisted on open voting; the New South Wales council in April rejected a motion by William Westgarth (q.v.) designed to test its feeling on the question; and open voting continued for another four years. In 1855, however, the grant of new ('responsible government') constitutions to the eastern colonies afforded another opportunity of raising the issue as the methods of election, etc., were left to the decision of local legislatures. On 1 November 1855 Sir R. G. Macdonnell, then governor of South Australia, officially advocated the ballot in his speech opening the session of council, and on the 20th Francis Dutton and G. S. Kingston (father of C. C. Kingston) gave notice of motions favouring the ballot. B. T. Finniss, then premier, yielded to this pressure, no one drove opposition to the point of a division, and on 2 April 1856 the machinery bill containing provisions for vote by ballot (voters deleting the names of candidates they did not favour) became law. Meanwhile the Victorian council had been preparing its electoral bill, and on 18 December 1855 William Nicholson (q.v.) moved that the ballot be adopted. The fight was fierce, Haines (premier), Stawell (attorney-general), Fawkner, O'Shanassy and other prominent men denouncing the system in unmeasured terms; very little, indeed, was known about it, for Stawell thought it would be worked with peas or marbles, and Nicholson himself had an idea of providing coloured boxes to receive votes for different candidates. The motion was carried against the government; Haines resigned; Nicholson after many attempts failed to form a ministry, and Haines, compelled to resume office, declared that he personally would oppose the ballot but the ministry would leave it an open question. H. S. Chapman (q.v.) now came to the front, and drafted a series of machinery clauses for Nicholson's adoption; these were included in the government's bill, and became law on 19 March 1856. Thus the Victorian act was slightly the earlier, though the South Australian proposals had been made first, and Westgarth in New South Wales had been the pioneer of the whole movement. Both colonies adopted the same mechanism, South Australia having a slight priority in this respect also; but in 1858 a new South Australian act introduced the method, invented by W. R. Boothby (q.v.), of printing a square opposite each candidate's name on the voting paper, and requiring the voter to put a cross within the square opposite the name of the candidate he favoured. Tasmania and New South Wales came into line in 1858; Queensland inherited the ballot when it was separated in 1859; Western Australia adopted it in 1870, and New Zealand in the same year.

The Australian ballot was adopted in Britain in 1872, in British Columbia in 1873, in the Dominion of Canada in 1874, in Belgium in 1877, and in Massachusetts, U.S.A., in 1888, other States of that Union following suit during the next 15 years. The British and Canadian methods are essentially South Australian; the Belgian ballot-paper provides for party 'tickets;' but the ballot-papers issued in the United States are monstrous sheets on which a voter has to mark his choice of sometimes hundreds of candidates for dozens of offices, as well as his attitude towards 20 or 30 pieces of legislation. The cross is the usual mark.

Baloghia, a genus of the family Euphorbiaceae, consisting of a few species, chiefly found in New Caledonia. *B. lucida*, the only species indigenous to Australia, ranges from New South Wales into Queensland. On the northern rivers of New South Wales it is known as 'scrub' or 'brush' bloodwood, and by the aborigines as 'dooragan.' The sap is blood-red, and makes an indelible paint, which has been used for marking bags, blankets, etc. A vertical incision is made in the bark, and a 12 hours' flow produces about half a pint. The wood (light brown in colour) is fine and close-grained; it shows no tendency to split, and is impregnated with a resinous substance which burns readily in a green state.

Bananas of the plantain variety have been grown as garden plants round Sydney since the earliest days of settlement. Their cultivation for the market was undertaken first in the Gosford district, and has since been established as an important industry in the valleys of the Richmond and Tweed, where in 1922-3 3807 acres were under cultivation, producing fruit valued at £210,170. In Queensland the banana is at home near the coast, particularly in the north, where its cultivation was for many years (and still partly is) carried on by Chinese; but European labour and methods and the use of manure have produced better crops. In northern Queensland the industry is diminishing, partly through the substitution of sugar-cane; in the south-eastern districts, under more favourable conditions of transport, it is develop-

ing fast, a protective duty having been imposed on imported bananas. Bananas are also grown in Western Australia, but on a very small scale. The total Australian crop for 1922-3 was valued at £660,825, grown on 14,619 acres. The types cultivated include not only many varieties of the ordinary banana (*Musa paradisaica*, var. *sapientum*) but also the so-called Chinese or Cavendish banana (*M. Cavendishi*), a cool-climate type with a comparatively thin rind and a delicate flavour.

In 1922-3 the disease known as 'bunchy-top,' whose origin and nature is still uncertain, did much damage in the plantations of southern Queensland and New South Wales. In August 1924 an otherwise unidentified organism was discovered in the roots, corms and leaves of affected plants, and this is being experimented with as a likely cause of the disease; its non-discovery earlier is probably due to the fact that it is motile only at certain seasons and quiescent during the greater part of the year. The university of Queensland is experimenting with plants resistant to the disease.

Bancroft, JOSEPH (1836-1894), born at Stretford near Manchester in the first half of 1836, and trained for the medical profession (M.R.C.S. Lond., M.D. St. Andrews), at first practised at Nottingham, where he developed a liking for the investigational side of his profession; he also became interested in the problem of packing salmon and trout eggs for transmission to Tasmania and New Zealand, and himself helped to pack the first batch of trout eggs that reached Tasmania alive. In 1864 he migrated to Australia and settled down to practise in Brisbane, but gave up a great part of his time to the study of hybridization, the pharmacology of the local flora, and the diseases of the banana and sugar-cane. He produced new varieties of strawberry, grape and castor oil plant, some of which proved commercially useful; he also made many experiments with the object of producing a wheat that could be cultivated profitably in a subtropical climate, established works for the preparation of a form of pemmican that found favour with the British war office, and devised a useful method of preserving fish. His investigations into the properties of the pituri plant led to the discovery of the mydriatic properties of a near relative, *Duboisia myoporoides*, which have placed its alkaloid, duboisin, in the Pharmacopoeia; another of his researches brought about the inclusion in that list of the bark of *Alstonia constricta*.

His most important discovery, however, was that (made in 1876) of the adult female form of a *Filaria*—named after him, by Cobbold, *Bancrofti*—which is responsible for many diseases of the lymphatic system in man. Early in 1877 he suggested that the embryos of these filariae were sucked in by mosquitos when biting human beings, and the same year Patrick (afterwards Sir Patrick) Manson in China, working independently, confirmed the suggestion by actual discovery; it was believed, however, that the young filariae, after metamorphosis within the mosquito, transferred themselves to water and were later introduced to human bodies in the act of drinking. In 1899 THOMAS L. BANCROFT, a son of Joseph Bancroft, suggested 'that the young filariae may gain entrance to the human host while mosquitos bearing them are in the act of biting,' and this was confirmed definitely both by himself and by Dr. G. C. Low. It was the discoveries and suggestions of Manson and the elder Bancroft that guided Ronald Ross to his parallel discoveries (1895-8) concerning the life-history of the malaria parasite in mosquitos; and the Bancrofts, father and son, may thus be considered pioneers in the development on which practically the whole of recent tropical medicine is founded. Joseph Bancroft, who was at one time president of the Royal Society of Queensland, died at Brisbane on 16 June 1894. —T. L. Bancroft has of late years turned his attention to breeding varieties of cotton-plant suited to the climatic conditions of Queensland (for details see COTTON), and samples submitted to the experts of the Imperial Institute in 1924 were favourably reported on.

Banded Anteater (*Myrmecobius fasciatus*), one of the most remarkable Australian marsupials, is usually classed with native cats in the family Dasyuridae, but by some zoologists is placed in a family by itself. Its size is that of a rat or squirrel; it has a light, graceful body, broad head and elongated sharp muzzle, pointed ears, long flexible bushy tail, and rather slender limbs, the hind pair longer than the fore. The rather coarse fur is reddish on the upper surface, darkening behind and crossed by nine bands of white; a white band occurs over the eye; the lower surface is pale yellow. The fore-limb has five clawed digits, the hind-limb only four, the first toe being absent. The teeth are remarkable on account of their number, which is greater than in any other marsupial or mammal, except the American armadillo and certain Cetacea. The female has no pouch.

The marsupial anteater is found only in certain districts of South and Western Australia. It is not nocturnal, but seeks its food—mainly ants, white ants, and sometimes other insects—by daylight. The ants are captured by means of the long narrow tongue. See MARSUPIALS.

W.A.H.

Banded Sea Perch, a rock-haunting species (*Gilbertia annulata*) which is not uncommon on the coast of New South Wales, though it rarely appears in the markets. It is marked with conspicuous black bands on a reddish ground, and its fins are deep scarlet. Smaller allied species, such as the Half-banded Sea Perch (*Gilbertia semicincta*) are commonly taken by seine-net fishermen in inlets along the coasts of the southern half of Australia.

A.R.McC.

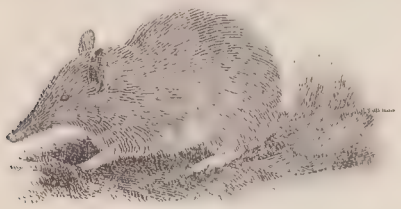
Banded Wallaby, a small wallaby (*Lagostrophus fasciatus*) living in scrub and on the margins of swamps in Western Australia. It differs from wallabies of the genus *Macropus* (see KANGAROOS AND WALLABIES) in various features of the skull and teeth, in having the two halves of the lower jaw immovably fused together, and in having the feet covered with long coarse hairs, which completely conceal the claws. The fur is thick and soft, of a general grey-brown colour above, with cross bands of white and black on the back; the lower surface is a mixed grey and white. The tail is uniformly covered with short close-set hairs, which are yellowish-grey above and dull yellow below; there is an inconspicuous pencil of longer hairs at the tip. See MARSUPIALS. W.A.H.

Bandicoots, a family (Peramelidae) of polyprotodont marsupials of small or medium size, insectivorous or omnivorous and of burrowing habits, restricted to the Australian re-

gion. The Common Bandicoot (*Isoödon obesulus*) occurs throughout extra-tropical Australia, including Tasmania; the Long-nosed Bandicoot (*Perameles nasuta*) is restricted to the eastern

Common Bandicoot.

districts, the Long-tailed Bandicoot (*I. macroura*) to northern Australia, and Gunn's Bandicoot (*P. gunni*) to Tasmania and south-eastern Victoria; the Striped Bandicoot (*P. bougainvillei*) ranges from Western Australia to New South Wales. Other species are found in Papua (five species), the Aru Islands, New Britain, and Duke of York Islands. All bandicoots are rat-like or rabbit-like animals with (in most species) coarse, bristly, brown fur, and long muzzle. The hind-limbs are rather longer than the fore-limbs. The fore-limb has the three middle digits long and clawed, the two outer being rudimentary or absent. The hind-limb has the first toe short and clawless; the second and third slender, with flat twisted nails, and united together throughout; the fourth long and powerful, with a strong pointed claw; the fifth like the fourth, but smaller. The length of the snout, ears and tail varies considerably in different species; the tail, usually long and hairy, is not prehensile. The teeth are numerous (46 or 48). The pouch of the female opens backwards. There are six or eight teats. Alone among marsupials the female bandicoot has a placenta; further discussion of this remarkable phenomenon will be found under MARSUPIALS.



Long-nosed Bandicoot.

Bandicoots live usually in companies or associations, and excavate burrows, numbers of which, branching in all directions, may form a veritable warren. In the open they run quickly, with movements not very different from those of a rabbit. Their chief food is of a vegetable character—mainly roots, bulbs, and tubers—and their burrows are excavated in search of these as well as for the sake of shelter. They also eat earthworms and a variety of insects, and are fond of grain of any kind. Useless to man as far as their fur and flesh are concerned, bandicoots, where they occur in large numbers, are capable of doing extensive damage—by their burrowings as well as by the loss of what they actually consume—to crops of potatoes, roots and grain. They may also cause much loss if they gain an entrance to granaries or wheat-stacks; but their inability to gnaw makes it easier to guard against them than against rats or mice.

Besides the ordinary bandicoots (*Isoödon* and *Perameles*), two other genera, *Choeropus* and *Thalacomys*—both confined to the inland parts of Australia—are comprised in the family Peramelidae. The Pig-footed Bandicoot (*Choeropus castanotis*) is so named on account of the structure of the fore-foot; this has a superficial resemblance to that of the pig, owing to the suppression of the first and fifth digits and the reduction of the fourth, the second and third alone being fully developed. It is a slight animal, smaller than a rabbit, with coarse straight fur of a general grey hue with a touch of fawn. The ears are long and narrow, chestnut on the backs, darkening towards the tips. Both pairs of limbs are long and thin. The hind-foot virtually consists of the large third toe. The tail is about half the length of the body, cylindrical, with a short inconspicuous crest above.

The Rabbit-bandicoot or Rabbit-rat (*Thalacomys lagotis*) is an animal about the size of an

Rabbit Bandicoot.

ordinary rabbit, but of slighter make. The snout is long and narrow, the ears very long. The hind-limbs are slender, and longer than the fore-limbs. The structure of both pairs is essentially the same as in *Perameles*, except that in the hind-foot the first toe is absent. The fur is long, soft and silky, of a general fawn-grey above, white below. The tail is about as long as the trunk, hairy throughout, the middle third black, the terminal third white. The flesh of the rabbit-bandicoot is said to be edible, and is highly valued by the natives.

The name 'bandicoot' is a corruption of a Telugu word meaning 'pig-rat,' and was originally applied to a large species of rat common in southern India and Ceylon. There is no evidence to show how it first came to be applied to the Australian animal, but Collins in 1802 (apparently reproducing Bass in 1799) uses it without explanation as a well-known name. See MARSUPIALS. W.A.H.

Banfield, EDMUND JAMES (1852-1923), born at Liverpool in England on 4 September 1852, was brought while a boy to Victoria by his father, who settled in Ararat. Adopting journalism as a profession, he worked on many newspapers in the three eastern States, during the nineties reaching Townsville in Queensland, where he joined the staff of the *Cleveland Bay Times*. Here after a few years of strenuous toil he was warned that phthisis would probably kill him within six months; he therefore abandoned journalism, and took a lease of Dunk Island—an islet about three miles square, lying off the Queensland coast half-way between Townsville and Cairns. From 1897 to 1923 he and his wife lived on this island simply and

healthily, Banfield devoting himself to the close study of tropical nature and of the aborigines of northern Queensland; he embodied his studies in *Confessions of a Beachcomber* (1908), following it up in 1911 with *My Tropic Isle* and in 1918 with *Tropic Days*—books that can never lose their charm or their value. He died on Dunk Island on 2 June 1923. *Last Leaves from Dunk Island* was posthumously published in 1925.

Banking. Sir John R. Paget, the greatest living authority on banking law, said in 1916 that no one was really a banker who did not habitually pay out money on cheques, and that nothing was banking business which did not include habitual payment of cheques. In 1915 Sir Samuel Griffith, late chief justice of the high court, declared that in Australia the term had never been used except to designate incorporated banking companies carrying on the ordinary business of banking, although it had sometimes been used by moneylenders in order to deceive the public. In his opinion, an institution upon which it was not lawful to draw a cheque was not a bank within the meaning of the bills of exchange act. In this article Griffith's definition has been accepted, and only cheque-paying banks are dealt with.

A description of banking as practised in Australia to-day would have horrified an English banker of a century ago, but happily the heresy of one generation often becomes the orthodoxy of the next. It cannot be claimed that any one of the leading traits which characterize contemporary banking practice in Australia is by itself peculiar to the country. It is rather in their combination and rapid adaptation that the distinguishing feature is to be found.

The branch-bank system has held the field from the beginning. The only known record of the existence of a private bank is in Widowson's *Present State of Van Diemen's Land* (1829), where it is stated that the Gellibrands, father and son (see GELLIBRAND, JOSEPH TICE), had a private bank in Davey-street, but did very little business. Until 1924 (see COMMONWEALTH BANK) there was never a banking monopoly in notes held by a privileged central institution, such as exists in England—where out of less than £30,000,000 worth of circulating notes over £29,000,000 worth are issued by the Bank of England. In Australia all banks had equal rights; when in 1910 the Commonwealth taxed bank-notes out of existence (substituting for them treasury notes under direct government control), they had long since become a minor factor in banking operations. Modern Australian banking business is based on deposits, and—except by a few recently established banks—interest is allowed only on deposits fixed for a term. Such fixed deposits permit of a greater range in making advances, and consequently (or concomitantly) the banks lend money freely on land. But land in Australia is usually a readily realizable security—at a price.

Thanks to Sir R. R. Torrens (q.v.) and the registration system, land can be transferred or mortgaged easily, cheaply and quickly, the validity of its title remaining beyond doubt. Banks also make advances on the security of growing crops, wool (even while on the sheep's back) sheep, and cattle, laws having been made to permit of acquiring valid security over these chattels. Banks also buy gold, and in the days of the early rushes this was a most important and profitable part of their business. Each of these departures from the orthodox tradition has been made under the stress of circumstance; but the Australian banker has never questioned the application to himself of the maxim that his success or failure is to be measured by the liquidity of his advances. In other words, his first duty is to his depositors, and to keep faith with them his investments must be of a readily realizable nature. The great crisis of 1893 may be regarded as the culmination of a period when this principle seemed to have been forgotten. That, however, was a national aberration, when even the wise and experienced were swept along in a current of unreasonable optimism. No country has escaped experiences of this sort, and no banking system ever invented by the brain of man can do more than alleviate the results of human folly.

Enterprising as the banks have been, they have never been lured into directly investing their funds in commercial or manufacturing enterprises, although much has been heard of German practice in this respect. In this they have steadfastly adhered to British tradition. There have been instances of banks affiliated to land companies, but the experiments were unhappy and not persisted in.

Australia, however, was and is primarily a pastoral and agricultural country; had the banks limited their business to discounting commercial bills, they would to-day be struggling for a precarious existence, instead of occupying a dominant position in the financial life of the country. They might, indeed, have been shouldered out by more vigorous rivals, capable of adapting themselves to the new environment. An illustration from the history of the United States will point the moral. According to the theory of banking which prevailed in America as late as the end of the 19th century, the chief function of a bank was to issue notes and discount bills. Hence the act establishing 'national' banks, although it authorized them to receive deposits, practically confined them to commercial deposits, because they were empowered to lend money only upon, or in discount of, commercial paper or bills of exchange. These national banks were created to help the government in financing the civil war, and no doubt served that purpose well; but, with the rapid reconstruction which followed the establishment of peace, the legal restriction on their powers prevented them from expanding as they might have done, and to maintain their place they had to ally themselves with trust companies or go under. These trust companies are practically banks, and absorb an increasing proportion of the real banking business of the country.

Australian banks, on the other hand, have been little hampered by legal regulations, and have been practically free to develop their usefulness, controlled only by public opinion. Publicity has been the rule from an early date, the banks having for many years been compelled by law to furnish to the government quarterly sworn statements of the average weekly balances, as explained below. One other characteristic may be mentioned. The banks make advances on current accounts by way of overdraft, and the tendency of this form of accommodation to displace bills of exchange, especially between wholesale houses and retailers, dates back many years and has been of steady growth. The shopkeeper who can, with the help of his banker, pay cash is free to buy where he likes, and in the long run all parties appear to benefit. Such are the chief characteristics of banks in Australia.

Legislation.—Banking is within the scope of the powers delegated to the Commonwealth parliament, but these have not yet been exercised with respect to the regulation of banking operations in general. State laws concerning banks (other than those enforcing publicity) are of small importance, and space does not permit of reference to them. As indicated above, Australian banks have developed with the country, and have adapted themselves to the growing needs of its commerce and industry. Freedom has been the rule; where restrictions (either legal or institutional) have proved irksome, they have been avoided or circumvented—sometimes even defied. Most banks that carry on business in Australia are incorporated under the companies' act. The others are under special acts of parliament, royal charter, or acts in council. The oldest, the Bank of New South Wales, was established in 1817 by an act in council, and re-incorporated by a New South Wales act of parliament in 1850.

Probably no act of parliament touches the banker's daily life at so many points as the bills of exchange act. Each colony had an act bearing this name, and closely modelled on the British act; but in 1909 these were replaced by a federal act which is practically identical with the British act. This facilitates business intercourse with the motherland, and makes available for general guidance the wealth of experience embodied in British textbooks and in the decisions of English judges.

Two other groups of laws have had a far-reaching influence on the development of Australian banking, and deserve more than a brief reference. The real property acts, by providing for registration, mortgage, and transfer of freehold lands at a very low cost, place a sound security in the hands of farmers and pastoralists who desire to borrow money to carry on their businesses. It must be reiterated that Australia is essentially an agricultural and pastoral country. Even to-day the greater portion of occupied Australia is held by pastoralists under lease from the crown. Before the discovery of gold, the wealth of the enterprising part of the community was in sheep and cattle, grazing on land to which the user had no title, or a very precarious one. Profits for a time were large, and this as usual led to riotous speculation, followed by the inevitable collapse (1823-1830). Having no security to offer, men of considerable wealth were reduced to bankruptcy. To meet the need of the moment, the New South Wales council passed an act 'to give a preferable lien on wool from season to season, and to make mortgages of sheep, cattle and horses valid without delivery to the mortgagee.' This was too revolutionary for the conservative mind of the colonial authorities in London, and was so repugnant to English commercial law that the act was vetoed several times; but the pertinacity of the men on the spot, who knew what they wanted, at last prevailed, and consent was given. Credit was re-established. The squatter, with a good security to offer, could turn part of the only wealth he had into money by pledging the whole, and could thus carry on his business. However it might perturb foreign legists, it soon became possible in Australia to hear that a grazier had borrowed money from one man on the security of his sheep, and from another on the pledge of his wool, while yet on the sheeps' backs. The climax was complete when the borrower, if possessed of freehold, obtained money from a third person by mortgaging his land. Crown leases soon became valuable, and provision was made to enable mortgages to be given over them, while a registered lien on a growing crop was legalized for the benefit of the agriculturist, whether freeholder or tenant. Australia is probably the pioneer in inventing an effective method of security over chattels that remain in the actual possession of the borrower.

Branch-bank System.—Australian banking institutions naturally bear the stamp of their British origin. Their salient features, however, derive more from Scotland than from England—notably the branch-bank system, and the advancing of money on current account. Also, until the Commonwealth monopolized the note issue, Australian banks, like their Scottish brothers, enjoyed the unfettered privilege of circulating their own paper in notes as low as £1. Scottish banks were firmly established in the 18th century as corporate bodies with numerous branches, so the safety and utility of this system had been tested by experience before Australia was founded. Historians of the industrial and commercial progress of Scotland always stress the potent influence of its banking system, and it is difficult to conceive what Australia's financial story would have been without its branch banks. Some other instrument might have equally well promoted its astonishing progress, but it is difficult to imagine what other kind of institution could have carried such abundant supplies of capital, at so small a cost, to the remote settlers in a sparsely populated land. The fierce opposition in the United States to the branch-bank system is incomprehensible to Australians. Complaints are occasionally heard here that too much money is withdrawn from the country districts to be used in the cities. Even if this had to be admitted, the advantages have on the whole been overwhelming. Probably in no other country do so many people (proportionally speaking) use a cheque book, and in no other country can remote settlers arrange loans so easily—for large amounts if necessary—at a branch office of a powerful bank. Keen competition has carried banking facilities into the most sparsely populated districts; the depositor has the security of an institution with large resources, which in turn are at the disposal of the borrower; the manager is under the control of men of wide experience, who command the means of meeting his requirements if he can justify them. The rapid development of Australia, especially since the gold discoveries, would have been impossible without a vast influx of British capital. The banks were the conduit-pipes through which it flowed, and its direction was largely determined by those responsible for their management.

The technical efficiency of banking in Australia is also of a high order, and will stand comparison with any known elsewhere. The Imperial Bank of Germany, in an annual report published during the war, thought it worth while to boast of having devised a scheme by which a payment could be made by a person in one town to a person in another by a book entry and letter of advice, without the use of currency or a credit instrument. If there is a banker living in Australia who can remember the time when a proposition of this kind was a problem to be solved, he must be a very old man.

Publicity.—In addition to publishing half-yearly or yearly balance sheets, every bank in Australia is compelled by federal law to supply the Commonwealth statistician quarterly with a sworn statement of its total averages, and by

State laws to furnish to the State government quarterly a similar statement of its assets and liabilities; these are published, in the press, and freely commented on by those interested in finance. The particulars supplied include deposits by the crown and by the public, notes and bills in circulation, balances due to other banks, and, on the assets side, cash, property, and all debts due to the bank. The ratio of liquid resources to the bank's liabilities—the sheet-anchor of sound banking—is thus revealed, and deviations from sound practice incur caustic criticism. The figures being weekly averages, the process known in England as window-dressing is reduced to a minimum. The public is protected, and one salutary restraint at any rate is placed on a banker disposed to rashness. A reform in this direction is much discussed at the present time in England, but a proposal to follow Australian practice would be regarded as extremely drastic, although two generations at least of Australians have been familiar with it.

Banking Business.—The great majority of Australian banks do not allow interest on current accounts. Five shillings per half-year is charged for keeping the account, and customers refund the price of the duty stamps which are impressed on cheque-forms for convenience at a government office. Fixed deposits are taken for 6, 12, and 24 months; for these interest is allowed, and receipts are issued, which are not transferable. A commission is charged for collecting cheques drawn on places outside the town where the deposit is made; as in Scotland, the charge is made at the time of each transaction. The rate varies roughly with the distance, but is usually uniform for all places within a State; in Queensland and Western Australia, however, the enormous distances between branches make very considerable variations necessary. One or two recently established banks both allow interest on current accounts and refuse to charge the half-yearly fee for keeping an account.

Though a bank's first business is to discount bills of exchange, a large part of the Australian banks' funds are loaned out on current account —that is, the bank allows a customer to overdraw up to a certain limit upon a more or less definite undertaking as to repayment. The rate of interest charged is about two per cent above the rates allowed on fixed deposits, and is calculated on the average daily balance of the actual advances; the customer has the right to pay off the overdraft without notice at any time.

The second function of a modern bank, the transfer of money from place to place, is in Australia performed with great thoroughness. Within the country the means employed are drafts, warrants, simple letters of advice, or telegrams; or travellers may carry a letter of credit which enables them to get cheques cashed in any place where there is a bank.

Foreign Exchange and Credits.—Nearly the whole of Australia's foreign trade, both imports and exports, is settled in London in sterling. The monetary unit of both countries being the same, exchange problems are simple compared with those of foreign bankers; but, as trade with America and the East grows, this simplicity may disappear. Australia being a gold-producing country, the banks were before the war frequent shippers of gold; occasionally they made shipments to India and the United States, but only to get the equivalent in London at less cost than by direct shipment. When the unlimited export of gold was prohibited, the gold-producers were permitted to form a company, to which was granted a licence to sell a limited amount of gold abroad for whatever currency could be converted at best advantage into Australian legal-tender money. For instance, in June 1921 it was reported in the public press that the association had sold 164,794 oz. in New York for 3,500,000 dollars; this made the net price in Australian currency approximately £5 8s. per oz. fine gold, or £3 17s. 10½d. for standard gold.

The Australian banks have correspondents in the principal cities of the world, and collect or pay debts due therein by bills of exchange. Travellers are supplied with circular letters of credit, which enable them to obtain foreign money in exchange for drafts on London. Documentary credits, varying in form, are supplied when required to cover imports into Australia. Before each wool season foreign banks establish credits with Australian banks, through which the buyers who arrive from abroad obtain the means to make their purchases; it is usual to lodge the shipping documents with the Australian banks as security. Other sales are financed in a similar way, and the keen competition for this class of business secures its working with a minimum of friction.

Clearing-house System.—Melbourne adopted the clearing-house system in 1868. Until 1914 all settlements were made in sovereigns. A pool for a substantial amount was formed, and the money placed in the control of three bank-directors, who issued certificates of £500 and £1000 denominations to the banks for their contributions to the pool. In Sydney the system (which was not adopted until 1894, owing to the opposition of some of the banks) differs somewhat in operation from that of Melbourne.

Bank-notes.—To meet the urgent demand for a regular currency (q.v.) the Bank of New South Wales was established in 1817. Notes were also issued by private traders until 1826, when this practice was officially suppressed, and by the various banks established before the gold rush. The discovery of gold, followed by the establishment of branches of the royal mint in Sydney and Melbourne, solved the currency problem of the colonies, and the rapid growth of the cheque-system soon made notes a negligible factor in banking operations. Australia affords no instance of reckless banking based on notes. In 1910 the Commonwealth government began to issue its own notes, and brought the banks' privilege to an end by a tax of 10 per cent per annum on their circulation. For years the banks had been paying a tax of two per cent to the various State governments (three per cent in Queensland), and it is doubtful whether they suffered any direct pecuniary loss by this action; it deprived them however, of facilities for supplying their numerous branches with till-money, and of coping by means of an increased note issue with the seasonal fluctuations in the demand for currency due to the marketing of wheat, wool, etc. A Commonwealth act (No. 11 of 1910) authorized the federal treasurer to issue notes, holding against them a gold reserve of not less than one-fourth of the total issue up to seven millions, and pound for pound for any sum in excess of that amount. An amending act in 1911 required that he should hold one-fourth of the total amount. The rest of the money derived from the issue he might invest on deposit in any bank, or in securities of the United Kingdom, the Commonwealth, or any

State; in 1920 his sphere of investment was extended to include trade bills with a currency of not more than 120 days. He was forbidden to pledge notes with any bank or person for money, but he might sell treasury bills for the redemption of his notes, if required. The 1910 act provided for full convertibility of the notes, and left the determination of the amount to be circulated at any time to the demands of the public. This amount on 3 August 1914 was £9,854,923; on 30 June 1923 it had risen to £52,102,025, a reserve of gold coin and bullion to the sum of £24,346,328 being held against this amount. By an act passed in 1920 the management of the note issue was transferred to the Commonwealth Bank, acting through a special board consisting of the governor and secretary of the bank, a leading treasury official, and two outside financial experts. For recent modifications of this scheme see COMMONWEALTH BANK. Statistics relating to the issue are incorporated (under a separate heading) in the balance-sheet of the Commonwealth Bank, though the notes remain treasury notes.

Financial Crises.—Australia has experienced its full share of violent financial crises. Over-speculation in sheep and cattle between 1825 and 1830 ended disastrously; again in 1842-3, after a land boom, the New South Wales banks, owing to the withdrawal by the government of its deposits in order to meet special obligations, were forced to restrict credit to such an extent that the whole financial machinery of the country was upset. Gipps, however, attributed the crisis entirely to over-speculation and the facility with which persons of no real substance obtained discounts at the banks. Capital had poured into the country rapidly between 1834 and 1840. In 1834 there were two banks in the colony with total paid up capital of £84,321; on 1 January 1843 there were seven banks with total paid up capital of £2,300,955; yet at the same time interest on money continued to rise reaching, in some cases, 15 per cent in Sydney. The banks as a rule weathered these early storms, and comparatively few failures were recorded. The Bank of Australia (Sydney, 1826) and the Royal Bank of Australia (London, 1840)—not to be confused with the present Royal Bank of Australia Limited—were liquidated in 1848. The Bank of Queensland failed in 1866, and the Oriental Bank Corporation in 1884, and a few other banks were absorbed. These, however, were mere financial ripples compared with the cataclysm that overwhelmed the banking world in 1893. Victoria was the storm-centre. For a decade English capitalists had been investing freely in Australia; according to the estimates of H. G. Turner, in 1885-91 £38,000,000 of borrowed money entered Victoria—an almost incredible sum compared with the population. This money, shared by land companies, mortgage and investment companies, building societies, municipalities, etc., was for the most part squandered in unnecessary undertakings. The market was flooded with land bills. Desperate efforts postponed the crisis until 1893, and then there was a panic. The Victorian government, by proclaiming a moratorium for five days (1-6 May 1893), increased the confusion. However, four banks—the Bank of Australasia, the Union Bank of Australia, the Royal Bank of Australia, and the Bank of New South Wales—refused to close their doors, and the others gradually resumed work. During the crisis 12 institutions, having 965 branches throughout Australia, with aggregate liabilities of over £100,000,000, had suspended business. Eleven of these banks were reconstructed, a portion of their liabilities being converted into fixed capital in the form of preference shares or stock. Only ten banks weathered the crisis; 23 failed between July 1891 and May 1893—five in 1891, four in 1892, and 14 in 1893. In New South Wales the pressure was relieved by the action of the government in making bank-notes legal tender and a first charge on assets for six months; nevertheless the colony suffered severely. The other colonies were more or less drawn into the vortex; the Queensland government took over the note issue in that colony, and maintained the monopoly until, nine years later, the Commonwealth authorities took control of the currency. The period of recovery was long and painful, the depression being prolonged by the low world prices obtaining at the time.

Banks.—Besides the Commonwealth Bank (q.v.) there are now 18 banks doing business in Australia, of which three have their head offices in London, five in Sydney, four in Melbourne, and one each in Brisbane, Adelaide, Perth, and Wellington (N.Z.). The Comptoir National d'Escompte de Paris and the Yokohama Specie Bank of Japan have branches in Sydney and Melbourne. The Ballarat Banking Company is a small bank with a local business. The bank amalgamation movement, so pronounced in Britain in recent years, has had its lesser counterpart in Australia, five amalgamations of two banks and one of three having been effected since 1917.

Statistics.—As several banks that do business in Australia have branches in New Zealand, and the Bank of New Zealand, whose head office is in Wellington, has branches in Australia, it is impossible to ascertain accurately the amount of banking capital employed in the Commonwealth. But the paid-up capital of the 19 banks that do business there was on 30 June 1923 over 52 millions, though of this 20 millions is accounted for by the two foreign banks with headquarters in Paris and Yokohama: the reserve profits of the 19 banks amounted to over 37 millions (over ten millions belonging to the two foreign banks). Roughly speaking, the assets of banks operating in Australia are cash and reserves, 47.1 per cent; advances, 51.4 per cent; premises, 1.5 per cent. Their liabilities are to shareholders, 12.1 per cent; to the public, 87.9 per cent. Very full details of assets and liabilities may be found in the successive Commonwealth Year Books and in the *Insurance and Banking Record.*

By the Commonwealth bank act the following institutions are recognized as banks in Australia:—

Australian Bank of Commerce.
Ballarat Banking Co. Ltd.
Bank of Adelaide.
Bank of Australasia.
Bank of New South Wales.
Bank of New Zealand.
Commercial Bank of Australia, Ltd.
Commercial Banking Company of Sydney, Ltd.
Commonwealth Bank of Australia.
Comptoir National d'Escompte de Paris.
English, Scottish and Australian Bank, Ltd.
Federal Deposit Bank, Brisbane.
Rural Bank of New South Wales.
National Bank of Australasia. Ltd.
Primary Producers' Bank of Australia, Ltd.
Queensland Deposit Bank and Building Society, Ltd.
Queensland National Bank, Ltd.
Royal Bank of Australia, Ltd.
Union Bank of Australia, Ltd.
Western Australian Bank.
Yokohoma Specie Bank, Ltd.

J. T.

Banks, Sir Joseph (1743-1820), only son of William Banks of Revesby in Lincolnshire, was born in Argyle-street, London, on 13 February 1743, and educated at Harrow, Eton and Oxford. During his first year at the university (1761) his father died, leaving him Revesby with an ample fortune; and in December 1763 he left Oxford with an honorary degree (M.A.), determined to devote himself to the study of natural science. Even at Eton he had begun this, picking up botanical facts from 'wise women' in the villages round Windsor and from torn old books discovered at home; and at Oxford, finding that botany was not taught there, he imported a lecturer from Cambridge—Israel Lyons—whose fees were paid by Banks and his fellow-students directly. At Revesby, after forming a friendship with Lord Sandwich (a neighbouring landowner) which was to affect considerably his subsequent career, he devoted himself to botanical studies with such zeal that in 1766 he was elected a fellow of the Royal Society—probably the youngest on record. In the same year he investigated the flora of Newfoundland, and in the following year made the acquaintance of Dr. Solander, a pupil of Linnaeus.

The transit of Venus due to occur in 1769, and the choice of James Cook (q.v.) to take charge of an expedition to the Pacific to observe it, gave Banks the chance of his life. Thanks to his friendship with Lord Sandwich—who was now first lord of the admiralty—he obtained permission to join Cook, and promptly got together a very full equipment for making collections in every branch of natural science, and a staff that included Dr. Solander and four artists. The story of the *Endeavour's* voyage is told under Cook, James and Exploration by Sea. The share of Banks in it was, as might be anticipated, mainly of scientific value, and its immediate result for him was that his university made him a D.C.L. But in the particular episode that is of most interest to Australians he played by far the most important part. Cook, a navigator by profession and instinct, was but slightly interested in the new lands he discovered except in so far as he considered them hindrances to navigation and fresh boundaries of the ocean which was his sphere. 'The discoveries made in this voyage are not great,' he told the admiralty. But Banks never forgot the new southern land. His first impressions, certainly, were unfavourable; 'barren it may justly be called, and in a very high degree . . . . upon the whole the fertile soil bears no kind of proportion to that which seems by nature doomed to everlasting barrenness.' But at that moment he had come from tropical islands, and was going back among tropical islands. Once back in England, the more his imagination dwelt on Botany Bay the better he thought it; and by 1779, when the house of commons was looking for a new location for a convict settlement, he had quite made up his mind that New Holland was worth occupying even in spite of its remoteness. By this time he was president of the Royal Society (elected on 30 November 1778), and a man of note and influence; when, therefore, he in 1779 advocated before a committee of the house of commons the establishment of a penal colony at Botany Bay, in 1783 warmly commended the proposal of James Mario Matra (q.v.) to colonize the country with loyalist Americans and Chinese, and in 1785 backed Sir George Young's revival of the Matra proposal, the British government became slowly convinced that the far-off country must really be of some value; and in 1786 it was decided to send a batch of convicts out as an experiment. When once the settlement was made, Banks (who in 1797 was made a privy councillor) set himself to make it a success by every means in his power. He was constantly consulted by the British government on matters relating to the administration of affairs in the new colony. He had a hand in the appointment of governors; King was his protégé, Bligh his nominee. The arrangements connected with the despatch of Flinders's expedition in the *Investigator* were left in his hands. No better illustration of the trust reposed in him can be exhibited than a slip of paper on which is written—'28th of April 1801—Is my proposal for an alteration in the undertaking of the *Investigator* approved? J.B.' 'Any proposal you may make will be approved. The whole is left entirely to your decision.' The last sentence is not signed, but was probably written by Evan Nepean, secretary to the admiralty. The governors almost invariably maintained a correspondence with Banks, giving him valuable information that was not contained in their official despatches. Hunter sent him specimens of the newly discovered coal. King, while still a minor official, brought him waratahs and Norfolk Island pines. Macarthur sent him fleeces—which he did not think much of. Kent took home for him emus and black swans. He provided the young colony with gardeners and explorers—though Mungo Park was not allowed to try his hand on the Blue Mountains. Robert Brown, George Suttor, George Caley, and Allan Cunningham all were friends and for a time employees of the great man. There is reason to believe that he actually refused high office on the ground that his services would be of more value to the colony if he kept aloof from ministerial responsibility. A memorandum in his own writing runs thus:—'I could not take office and do my duty to the colony. My successor would naturally oppose my wishes. I prefer, therefore, to be friendly with both sides.'

By the time he reached middle age, he occupied a unique position in the scientific and social world of England. He had achieved a reputation for universal wisdom, and was approached for information on subjects as various as hydraulics, tanning, the plucking of geese, coinage, earthquakes, and his pet subject botany. He was a diligent member of the Society of Arts, the Engineers' Society, the Dilettante Society, and the Society of Antiquaries; a founder of the Royal Institution, and a member of the National Institute of France. His active connection with Australian affairs, however, diminished considerably when Macquarie, first of the soldier-governors, initiated the new regime, though he maintained his interest in the country through Allan Cunningham and others, and was entrusted with the superintendence of the draughtsmen and engravers who prepared Flinders's charts, etc., for his *Voyage to Terra Australis.* It was probably a sign of failing energy and growing conservatism that he prevented Flinders from using in that book the name 'Australia' which the author so much favoured, and insisted on the retention of the cumbrous Latinism which disfigures the title. His interests, however, if narrowed in one direction,

widened elsewhere, and he actively promoted explorations in China, Brazil, Sumatra, Egypt and the Congo valley. For at least 14 years before his death he had lost the use of his legs, but continued to preside actively over the Royal Society, and gathered round him such savants as Stamford Raffles, Barrow, Hooker, de Candolle, Humphry Davy and W. E. Parry. On 16 March 1820 he sat for the last time in the chair at a council meeting; on 18 May he offered to resign, but the council refused to let him; on 19 June he died without issue. (Baronet, 1781; K.C.B., 1795.) See OBEREA.

Banksia, a genus of the family Proteaceae, endemic in Australia, containing some 48 species of stunted trees. The flowers are in pairs in dense cylindrical oblong or globular spikes; corolla straight or curved, the slender tube opening equally or along the lower side only, the segments remaining coherent, or rarely separating as the tube opens; anthers seated within the concave segments of the corolla;

Honeysuckle.
(*Banksia collina*)

style longer than the flower; fruit a compressed capsule, opening at the broad end in 2 horizontal valves; seeds 2, compressed, with a terminal membranous wing, broad and rounded like valves; leaves alternate, entire, toothed, or deeply divided. In the fruit the floral bracts become consolidated with the axis of the spike into a thick woody cone. The proportion of perfect capsules to flowers is usually very small. The genus is named after Sir Joseph Banks. The popular name 'Honeysuckle' is generally applied to the Banksias, whose flowers contain honey in considerable quantities; 'Bottle-brush' (a name frequently bestowed on the *Callistemons*) is also in use. *B. ericifolia* would be a useful shelter-tree in low-lying or swampy land. *B. aemula, B. dentata, B. littoralis,* and *B. marginata* have ornamental timbers which are, however, only available in small sizes, and require to be carefully seasoned.

Banksia serrata (Red Honeysuckle), is a gnarled tree reaching 50 feet in height with a trunk diameter of 3 feet, usually growing on poor, sandy soil. The tuberculate, corky bark contains tannin. The timber is a purplish-red with a coarse grain. It is a good working timber, not liable to split with nailing, and is reputed to last well. It is used for window-frames and boats' knees. A dark red gum or resin is obtained from this species; this renders the wood specially useful for camp fires, as it is readily combustible both green and dry.

Banksia integrifolia (White Honeysuckle), is a tree of 40-50 feet high. The specific name implies an entire leaf margin as a distinguishing character; but it is not altogether reliable, as the margins are frequently more or less deeply toothed. It ranges from Victoria to Queensland, mostly haunting the coastal districts, but extending in places to the tablelands. It is capable of withstanding the harsh conditions of the sea-coast, where it frequently forms groves on the dunes, and is valuable for sand-binding and reclamation. The pinkish timber has a neat grain, and is used for boats' ribs and knees. The bark is occasionally used for tanning.

Bannerman, CHARLES, born in Sydney on 3 July 1851 and still living, was one of the most brilliant batsmen ever reared in Australia, though he took part in very few important matches. In the first test match between England and Australia, played at Melbourne on 15 March 1877, he made the first century recorded in test cricket—165 retired hurt: no other Australian batsman made more than 20 in either innings, so that Bannerman's score won the match for Australia, and £165 was collected on the ground and presented to him there and then. As a member of the Australian eleven of 1878—that notable collection of pioneers who laid the foundation of Australia's greatness in cricket—he was the first Australian batsman to score 100 against English bowling in England, a feat which he repeated against local bowling both in the United States and in New Zealand.

His younger brother ALEXANDER CHALMERS BANNERMAN (usually known as 'Alick'), born on 21 March 1857, was a member—at the age of 19—of the same eleven; but his temperament was exactly opposite to that of Charles, and his batting reflected it. He was the greatest stone-waller Australia has known. He visited England with the teams of 1878, 1880, 1882, 1884, 1888, and 1893; he played against England in 28 test matches, scoring over 1000 runs in 50 innings, and thus obtaining an average of 23.08. In those days, it must be remembered, wickets were inferior to those of to-day, and the bowlers Alick had to meet were of a quality no one has ever questioned. His patience was inexhaustible, his defence rock-like, and he invariably went in first for Australia. Perhaps his finest achievement was in the Sydney test match of 1892

against an eleven brought out by Lord Sheffield and captained by W. G. Grace. Going in for the second innings in face of a deficit of 162 runs, he batted for 7½ hours, scoring 91 runs—one of the most valuable innings ever played in a test match. Alick was also a great fieldsman at mid-off.

Charles has frequently officiated as umpire in 'big' cricket, and Alick was for some years official coach at the Sydney cricket ground. Both were shrewd judges of the game and the players, and did yeoman service in helping to develop the skill of a later cricket generation. Alick died at Sydney on 19 September 1924.

See CRICKET. L.O.S.P.

Bannister, SAXE (1790-1877), born at Steyning in Sussex on 27 June 1790, and educated at Tonbridge and Oxford (B.A., 1813; M.A., 1815), during the 'hundred days' of Napoleon's return to France in 1815 raised a company of militia and was given a captain's commission therein. After Waterloo he retired on half-pay and was called to the bar from Lincoln's Inn. When on Bigge's recommendation it was decided to appoint an attorney-general for New South Wales, Bannister obtained the appointment, and reached Sydney on 5 April 1824, bringing with him the 'Charter of Justice' by which the first supreme court was established in the colony. While able and high-minded—Darling, who quarrelled with him, describes him as 'a Philanthropist almost in the extreme, often misled by an injudicious zeal, but indefatigable, conscientious and honorable in the highest degree'—he was inclined to magnify his office and insist upon his personal rights to an extent which antagonized even Brisbane. The clash came when Brisbane ordered him to prepare a bill indemnifying certain magistrates (among them Samuel Marsden and Hannibal Macarthur) for irregularly condemning convicts to floggings, not for crimes committed, but in order to extort confessions of crime or evidence against other convicts. Bannister declared that such a bill conflicted with 'the fundamental law of England' and its draftsman might be exposed to punishment; Brisbane maintained that the attorney-general's opinions were irrelevant and his office in this respect 'merely Ministerial'—i.e. that it was his duty to draft any bill 'which may be required by the Governor with the advice of the Council.' The dispute was remitted by Brisbane to the colonial office for decision: but meanwhile Bannister had been worrying Earl Bathurst with requests for an increase of salary (he was originally allotted £600 with leave to increase to £1200 by private practice, but had little spare time for the latter), the British authorities decided to replace him by a less important official, and Bathurst seized with joy the opportunity of leaving the constitutional dispute undecided.

With the arrival of General Darling (q.v.) there began an era of party quarrels within the framework of the colonial government, John Macarthur with Archdeacon Hobbes Scott, attorney-general Saxe Bannister, surveyor-general Oxley and Dr. Bowman forming a quite definite Opposition in the inner circles. In Darling's eyes, however, Bannister was the least objectionable of the bunch, and several passages in this governor's early despatches show a quite unusual admiration of his character and work. But in June 1826 Bannister refused to sit at Darling's table with Dr. Wardell, who as editor of the *Australian* was bitterly attacking the Macarthur party, and was at the moment receiving Darling's support; and from that time on Darling's adjectives altered. Bannister was now 'eccentric,' 'extremely weak and easily led astray,' so hasty 'that no dependence can be placed on the soundness of his opinions or the expediency of the measures he proposes;' and Darling began to urge on the colonial office 'his unfitness for his situation' and the necessity of appointing a successor at once. In September arrived the despatch announcing the appointment of a successor, and Darling immediately seized the chance of dismissing Bannister and nominating the government solicitor to fill his place pending the new appointee's arrival. The dismissal was followed by press attacks on Bannister's character, one of which, in the *Australian*, was extremely malicious; but Darling refused to prosecute on the ground that the victim was no longer a government official, and Bannister, determined to lay his case before the authorities in London, sailed on 22 October, after fighting on the 21st a harmless duel with Dr. Wardell. His Australian career is chiefly remarkable for the quarrels with Brisbane and Darling; but it must not be forgotten that he founded the first infant school in Sydney, and took an active interest in the treatment of the Australian aborigines by white settlers. During 1827 he was stationed at the Cape of Good Hope, but was recalled to England early in 1828.

After his return to England little is known of his doings, except in so far as he wrote a good deal on legal and historical subjects. The colonial office rejected his complaints about Darling's behaviour, and a later appeal for compensation (in 1853) was equally unsuccessful. In 1838 he helped to found the Aborigines Protection Society; in 1848 he was appointed bedel to the Royal College of Physicians, London, and thenceforth busied himself a good deal with the life and work of William Paterson, the founder of the Bank of England. He died on 16 September 1877, at Thornton Heath near London.

Baptists. The Baptists in Australia hold, numerically, the fifth position among religious denominations. Being congregational in church government, and independent in church polity, their early history must necessarily be a record of individual churches; only in 1858 did these become sufficiently numerous to combine in unions. In 1831 there arrived in Sydney from England John McKaeg (q.v.), a fully accredited Baptist minister, and the Sydney *Monitor* of 27 April announced: 'A Mr. McCabe has commenced preaching in the long room of the Rose and Crown Inn, Castlereagh-street. On Sunday last (24th) a few persons of the Baptist persuasion attended.' Services were subsequently held in a room in King-street, and in a larger room in Hart's Buildings, Pitt-street, where a Church was formed. The first baptisms took place in Woolloomooloo Bay, at the foot of Bourke-street. In September 1832 the governor granted the site upon which the Bathurst-street church now stands. Funds were raised, and building material purchased, but the erection was delayed, and early in 1834 McKaeg resigned. In response to a request made to the Baptist Missionary Society in London, John Saunders arrived on 1 December 1834, and held services in a room in the old court house in Castlereagh-street (which afterwards became the girls' high school); simultaneously the erection of the

Bathurst-street church was resumed, and the church was opened on 23 September 1836 at the modest cost of £1400. The first membership had apparently lapsed, for on 17 November 1836 the Church was again formed; it included several who were not Baptists, and was therefore formed on an 'open membership' basis, but in 1840, after the transfer of several members to the Pitt-street Congregational Church, the constitution was changed to 'close' membership with 'open' communion. Saunders did much to establish the Baptist position before ill-health compelled him to resign in 1847. He was succeeded by John Ham, of Melbourne, who died after four and a half years' ministry. A second application to the Baptist Missionary Society brought out James Voller, who had the misfortune to be shipwrecked on Amsterdam Island, but eventually reached Sydney on 30 December 1853, and exercised his ministry for 17 years. The second Baptist Church was formed at Parramatta in 1851, and was followed by the formation of Churches at Smithfield and Hinton (1857), Newtown (1860), Maitland (1861), Harris-street, Sydney (1862), Bathurst (1863), and Newcastle and Wallsend (1864).

Baptists of the 'strict and particular' order met first in the schoolroom of Joseph Kemish in Macquarie-street, Sydney, and afterwards in Kent-street, under the ministry of Simeon Emery, until in 1858 the congregation of the Goulburn-street church was dissolved, and they occupied that building. Pastor John Bunyan McCure succeeded Emery, and a Church was formed on 4 July 1861. In 1863 the building in Castlereagh-street was erected, and for a period of 21 years was the scene of the labours of Pastor Daniel Allen.

Tasmania claims the second Baptist Church in Australasia. Henry Dowling, a Strict Baptist minister, arrived at Hobart on 2 December 1834, proceeded in February 1835 to Launceston, preached in the court-house, and decided to reside there and itinerate through the island. On 14 June 1835 a Church was formed in the house of W. J. Ware at Hobart; this, with one formed about the same time at Launceston, constituted 'The Particular Baptist Society of Van Dieman's Land' of which organization Dowling became secretary. Land granted for a building at Launceston was sold, and the first church building was erected there on a purchased site in York-street. In 1840 a building was erected in Harrington-street in Hobart. Dowling died in 1869. In 1846 S. Hewlett of Wollongong in New South Wales became pastor of the Hobart Church. A visit from Thomas Spurgeon in 1880 gave a considerable impetus to the work, but the chief advance was due to the denominational loyalty and generosity of William Gibson, his wife and son, of Perth in Tasmania. The benefactions of the Gibson family (including £11,000 to establish a sustentation fund) amounted to almost £70,000.

In *Victoria* Baptists first met in a tent in 1838; services were conducted by Peter Virtue and James Wilson. A Church was formed in 1839, and several persons were baptized on the beach below Emerald Hill. John Joseph Mouritz, who belonged to the Scottish Baptists, arrived in 1840, combined dairying with the ministry, and conducted services in a room in Collins-street where the Victoria coffee palace now stands. This room belonged to Samuel Crook, who came from Sydney, and whose wife was the first person baptized in Melbourne. In 1841 a move was made to Little Collins-street, where Presbyterians had granted the use of a small wooden building. In December 1842 John Ham, whose passage was booked to Sydney, was prevailed upon to stay in Melbourne, and Mouritz in 1843 formed a Church in Fitzroy, where he lived. The site of the Collins-street church was then secured from the government, and the opening services were held on 28 December 1845. Ham left for Sydney in 1848, and was succeeded by J. Taylor, J. Martin, and (in 1877) Samuel Chapman.

In *South Australia* the first Baptists to settle were W. Finlayson and his wife in 1837. They were joined shortly afterwards by David Maclaren, manager of the South Australian Company. In July 1838 13 Baptists met in Finlayson's house and formed themselves into a Church, and on 2 September they began services in a schoolroom that had previously been the banking office of the South Australian Company. D. Maclaren (father of Dr. Alexander Maclaren of Manchester) conducted the meetings, but declined to accept the pastorate. In 1839 a removal was made to a building previously used by Wesleyans; and after some vicissitudes a new congregation was formed and a building opened in Franklin-street on 4 January 1846. Meanwhile in 1843 a Church had been formed in North Adelaide, and a building erected in Kermode-street, under the pastoral care of James Allen; this was used until his departure in 1846. A Church was also formed in 1843 at Gumeracha under J. P. Butterfield. In 1847 George Stonehouse re-formed the Church in Kermode-street, which was occupied until a new building was opened in Lefevre Terrace in 1850. The most powerful influence upon Baptist life in South Australia was exercised by Silas Mead, who arrived in 1861, formed a Church in Flinders-street, and ministered to it for 34 years.

Baptists in *Queensland* were much indebted to the immigration scheme of Dr. Lang (q.v.). Adherents of the Presbyterian, Congregational, and Baptist denominations, being too few to establish separate churches, joined in a 'United Evangelical Church' with Charles Stewart, who had come out by the *Fortitude* in 1849, as the first minister. A building was erected in William-street, Brisbane, where the executive building now stands, and it was provided that, when the various denominations felt sufficiently strong to separate, this building should be sold and the proceeds divided between them. On 5 August 1855, the Baptists resolved to form a separate Church, and (Stewart having returned to England) invited Charles Smith of Sydney to the pastorate. They first met in the old police court, and afterwards in the old supreme court, Queen-street. As a number of Congregationalists desired association with them, the Church adopted the 'open membership' basis, but on the formation of a Congregational Church this was changed on 20 April 1857, to 'close' membership and 'open' communion. When Smith left Brisbane, the Church appointed as pastor one of its foundation members, R. A. Kingsford. In June 1857 J. Voller of Sydney visited Brisbane, exciting much enthusiasm, and baptizing in an open water-way near the present Roma-street markets George and James Grimes, members of a family of staunch Baptists who had come out under Dr. Lang's scheme. On Voller's advice the Church applied to the Bap-

tist Missionary Society, and B. G. Wilson arrived on 12 September 1858. The William-street building having been sold for £1500, the Baptists received about £500, purchased a site in Wharf-street, and erected a stone building at a cost of £2050. At the opening service on 6 February 1859 Wilson baptized 20 persons. The second Baptist Church was formed at Ipswich. Samuel Welsby, a teacher who arrived in the *Fortitude*, commenced there services which resulted in the formation on 17 March 1853 of a Union Church with Thomas Deacon, a Baptist, as its first pastor. In the following year a Congregational Church was formed, and according to arrangement Deacon retired, but in January 1860 he became pastor without emolument of a Baptist Church then formed. It met first in a bowling alley, but a small church was soon erected in West-street; Deacon died on the day of its opening. 'Jireh' Church in Fortitude Valley was formed on the 'strict' basis on 2 December 1861, with John Kingsford as honorary pastor. In Rockhampton two earnest Baptist brothers, W. H. and C. H. Buzacott, started the first newspaper in that town. After a visit from B. G. Wilson, services were started in W. H. Buzacott's house, and on 25 January 1862 a Church of seven members was formed.

Western Australia was the last Australian colony to establish a Baptist Church. Services had been held in Perth by George Johnson, but no Church was formed until after the arrival from Victoria of J. H. Cole, who held meetings in Perth town hall in October 1894. Churches were formed at Fremantle in 1895 and at Katanning in 1896, the first building being erected at Bayswater in 1896. Cole returned to Victoria, and was succeeded by A. S. Wilson, a young man of unbounded enthusiasm, under whose ministry much progress was made, and the building in Museum-street was opened on 5 May 1899. As Wilson felt constrained to advocate 'open' membership, a Church on 'close' membership lines known as the North Perth Baptist Church was formed under the leadership of J. W. Jaques as honorary pastor.

A Baptist Union is on a voluntary basis, and possesses no legislative authority except by agreement among the component members, but the desire for fellowship and for the extension of the Kingdom of God invariably leads to steps for the close association of Churches of the same faith and order. Thus on 20 July 1858 a meeting held in the vestry of the Bathurst-street church in Sydney decided to form an Association of Baptist Churches, and drafted a basis. On 21 September the first meeting was held at the same church, delegates from the Bathurst-street, Parramatta, Hinton, and Smithfield Churches being present. A 'Colonial Missionary Society' was formed for home mission work. For some reason the association lapsed, but ten years later, after an address by Pastor D. Allen in the Castlereagh-street church, J. H. Knibbs on 27 December 1867 convened a meeting in his own house; a further meeting on 3 January 1868 was attended by representatives of three Churches, but two only (Masonic Hall and Newtown) formed themselves into an Association, framed a draft constitution, and appointed Allan W. Webb secretary. The first official meeting was held on 11 February in the Castlereagh-street church. Delegates present represented four Churches, and three others were affiliated, but for various reasons some Churches did not immediately seek admission. On 20 January 1869 the Association comprised 11 Churches and 359 members, and at the third annual meeting on 19 January 1870, 18 Churches were represented—all there were in the colony except the 'strict' Churches. The name was then changed to 'Baptist Union of New South Wales.' Steps were at once taken to educate young men for the ministry, and to organize a preachers' society and an auxiliary of the Baptist Missionary Society. In 1871 the Colonial Missionary Society mentioned above was merged in the New South Wales Home Mission Society. A resolution was carried 'to secure the co-operation of all the Colonies in some common plan of action by means of an Australasian Baptist Union.' In 1872 a resolution was carried, on the motion of James Greenwood, then pastor of the Bathurst-street Church, 'That the Baptist Union protests against the extension of Denominational Schools at the expense of the State, as being another form of State Endowment of religion.' Greenwood is understood to have been the real father of the New South Wales education act passed in 1880 by Sir Henry Parkes.

Unions with similar objects and methods of operation were formed in other colonies—Victoria in 1862 (comprising 10 country and 6 city Churches), South Australia in 1863 (with about 12 Churches), a Northern District Association in 1884, Queensland in 1877 (with 7 Churches), Tasmania in 1884 (with 8 Churches), and Western Australia in 1896 (with 4 Churches).

Some of the early Churches displayed remarkable zeal, their members travelling widely and holding meetings in cottages and public buildings. With the formation of Unions the organization of home missions became specially important. Mention has been made of the Colonial Missionary Society in New South Wales, and in 1872 the Union directed the New South Wales home mission 'to aim at the establishment of a Christian Church in every centre of industry throughout the colony.' But the Churches were few and small, and a marked development did not occur until the superintendent, A. J. Waldock, was set free in 1908 to devote his whole time to the work. More than half the Churches in New South Wales owe their origin to home mission enterprise. In Victoria a society was formed in 1871, but made little progress until the appointment of F. J. Wilkin as superintendent in 1893. In South Australia the Union was practically a home mission society, and its formation initiated the expansion of the Baptist cause. The same may be said of other States.

Unions having been formed at a time when great interest was being displayed in foreign missions by Baptists in England, it was natural that Baptists in Australia should contribute to the funds of the missionary society in London. Silas Mead was an enthusiast for foreign missions, and on 10 November 1864 called a meeting at the Flinders-street church in Adelaide, at which it was unanimously agreed to organize a South Australian Missionary Society. At first the committee sent money to India for the support of native missionaries; but in 1865 J. C. Page, from India, who visited Australia in search of health, met the recently formed society, and urged that it should take up a definite mission-field, offering to give partial oversight to such a field in Bengal. Faridpur in eastern Bengal was selected, and the committee guaranteed £100 a year for the support of four native preachers and a schoolmaster. In 1881 two Australian ladies, Marie Gilbert and Ellen Arnold, offered for zenana work, and in October

1882 left for India. Two years later Miss Arnold had to return through serious illness. Recovering her health, she proceeded as missionary evangelist to all the Australian colonies except Western Australia; her advocacy greatly stirred the Churches, and she took back other workers on her return to Bengal in 1885. The mission house at Faridpur became a general training school for missionaries who there acquired the language and went to other districts in eastern Bengal. The foreign mission workers were the first to realize the advantages—and the urgency—of united effort, and after steadily increasing co-operation complete federation took place in 1922. The Australian board of Baptist foreign missions has its headquarters in Melbourne, with branches and committees in every State. Ten districts in eastern Bengal are occupied, with eight out-stations. Australian missionaries and wives number 37, with 22 native preachers, 12 colporteurs, 11 Bible women, a Church membership of 1988, and a Christian community of 4166. The foreign mission estimates total about £16,000 yearly. A monthly journal, *Our Indian Field*, circulates among the Australian Churches.

The work of home missions involved the training of young men for that ministry, and as early as 1871 a Baptist educational institute was formed in New South Wales and classes started under the direction of James Greenwood. Similar steps were taken in other colonies. In Victoria in 1884 an anonymous donor offered £25,000 conditionally upon the raising of a similar amount. This 'Victorian Baptist Fund' was to be used (*a*) for the establishment and maintenance of a college for training students for the ministry, (*b*) for a church loan and building fund, (*c*) for a ministers' sustentation fund, (*d*) for an aged ministers' fund. Under the leadership of Samuel Chapman the Churches accepted the offer, and the fund was completed in 1886, the Jubilee year of Victorian Baptists. The fund now amounts to £78,000. In accordance with its objects a Victorian Baptist college was established, with Dr. W. T. Whitley as principal, and started work in 1891; in 1911 W. H. Holdsworth became principal. At first students from other colonies, especially from New South Wales, took advantage of the college; but it was found that the terms of the trust did not permit non-Victorian students to receive pecuniary advantage, so in 1916 a college was established in New South Wales under Principal Alexander Gordon, who resigned in 1920 and was succeeded in 1921 by G. H. Morling. The South Australian Union has a mutual arrangement for educational purposes with the Congregational Union, and Queensland utilizes the services of ministers holding pastorates. In most States some subjects are studied at the local university, and others in conjunction with the colleges of other denominations. Victoria leads the ways in secondary school education, the Carey grammar school having been opened in 1923; it possesses a fine property at Kew.

The Victorian Baptist Fund included an aged ministers' fund, the capital of which now stands at £11,000. In New South Wales a fund, established in 1900 by the generosity of Hugh (afterwards Sir Hugh) Dixson, has a capital of £12,250. South Australia has a contributing fund, with a capital of about £12,000. In Queensland the fund has reached only £500. Western Australia has a capital of £1500. The basis of the South Australian fund is regarded as the most suitable for all the States, and resolutions carried by the congress (see below) recommend other States to adopt a similar basis, so that the removal from one State to another will not deprive any minister of the advantage of the fund; but the terms of the different trusts present serious difficulties. Loan and building funds for the assistance of Churches exist in most of the States.

The desire for federation found early expression, but the most important step in that direction was the holding of the first Australasian Baptist congress in 1908 in Sydney. The second was held in Melbourne in 1911, but owing to the war the third was not held until 1922. One result already mentioned has been the federation of foreign missions. A weekly paper, *The Australian Baptist*, which first appeared in 1912, took the place of monthly papers published in each State, but after several years the monthly papers were resumed in all States, being supplementary to the *Baptist*. At the third congress a first step was taken towards inter-State home missions, and the forming of an Australian Baptist Union has been considered. Business between meetings of the congress is carried on by an inter-State board, with representatives in each State.

In the census of 1921 105,703 persons enrolled themselves as Baptists. In association with various Unions there are in New South Wales 76 Churches, 72 ministers and home missionaries, 6469 Church members, and 8300 Sunday-school scholars. In Victoria the figures are 90, 89, 7419, and 10,688 respectively; in South Australia 80, 57, 5148, and 7699; in Queensland 46, 34, 3468, and 4937; in Tasmania 18, 20, 1407, and 2167; and in Western Australia 27, 17, 1175, and 1607. The totals for Australia are 336 Churches, 292 ministers and home missionaries, 25,086 Church members, and 35,398 Sunday-school scholars. There are also a large number of preaching stations connected with the Churches.

W.H.

Barff, Henry Ebenezer (1857-1925), born on Tahiti in the Society Islands on 9 July 1857, was brought by his parents to Australia in 1865 and educated at the university of Sydney (B.A., 1876; M.A., 1882). In 1876 he was appointed a master of studies at the university, in 1878 a mathematical lecturer, and in 1880 acting-registrar. In 1882 this appointment was made permanent, and in 1914 was dignified for him with the additional title of 'warden.' His life was thus bound up with the university, of which he was for many years the senior and the most experienced official, the guide of four chancellors, 11 vice-chancellors, and numberless professors. In his time the institution grew from a body of four professors and about 50 students to one of nearly 250 teachers and staff with over 5000 students. In November 1922, worn out by the strain of administration during the war and the period of over-crowding that followed it, he offered to resign; refusing the offer and granting him instead long leave of absence, the senate by resolution attributed to him 'such performance of duty as places him historically among the chief makers of the university, and will remain its model of highest executive capacity and achievement.' On 31 August 1924 he retired from all active work, and died at Sydney on 2 May 1925. His only written work is *A Short Historical Account of the University of Sydney*, published in 1902. (C.M.G., 1923.)

Barker, COLLETT, entered the army in 1806 (ensign, 1806; lieutenant, 1809; captain, 1825—all in the 39th regiment), and during 1828 joined his regiment in Sydney, being sent away almost immediately to take over the establishment at Raffles Bay in northern Australia from his fellow-officer George Sleeman, who had been transferred to King George's Sound. Reaching the Bay on 13 September, he worked hard to ensure the health of the settlement and to conciliate the neighbouring aborigines, who had been always hostile to the settlement and in 1827 had come into collision with the garrison. Barker established his reputation with Darling by his handling of both these problems, and was able in February 1829 to report both that the garrison was healthy and that the blacks were friendly and frequent visitors. He deprecated the despatch to the Bay of soldiers 'under 25 years old or of a weakly, scrofulous or indolent habit.' In February he received the personnel and stock of the Melville Island settlement, which the British government had decided to abandon; in July he was ordered to abandon Raffles Bay also, transferring the settlement to King George's Sound. This decision, he thought, was unfortunate, as in March, April, and May the Bay had been visited by a large number of Malay fishermen and traders from Macassar; the Dutch governor of that place and the visitors themselves had been delighted to find a permanent British settlement so handy to their trepang fishing grounds, and its premature abandonment was disappointing and disadvantageous.

On 28 August Barker sailed from the Bay, leaving a flag flying at the fort there, and proceeded via Kupang and the Swan River to King George's Sound, where on 3 December he again succeeded Sleeman as commandant. His tenure of command there (which was praiseworthy but uneventful) ended in January 1831, when the colonial office decided to place the Sound under Stirling, then in charge of Swan River. Darling at once arranged to make Barker Resident at the Bay of Islands in New Zealand, where his known ability for handling uncivilized tribes would make him a valuable intermediary with the Maoris. But on his way back from the Sound Barker by instructions landed in April at the mouth of the Murray, to discover whether any communication existed between Lake Alexandrina and the Gulf of St. Vincent. Finding none, he swam the mouth of the river with the intention of trying to find some better outlet from the lake to the sea, disappeared over a sandhill, and was never seen again. It was afterwards ascertained that he had been speared by natives. Barker's zeal and ability were warmly praised both by Darling in a government order and by Goderich, then colonial secretary, in a special despatch of 24 December 1831.

Barker, FREDERICK (1808-1882), born at Baslow in Derbyshire, England, on 17 March 1808, was educated at Jesus College, Cambridge (B.A., 1831; M.A., 1839), ordained in 1831, and spent three years as curate of Upton in Cheshire. From 1835 to 1854 he held the living of St. Mary's at Edgehill near Liverpool, and in 1854 was transferred to Baslow, but in August Archbishop Sumner chose him to succeed Dr. Broughton as bishop of Sydney and Metropolitan of Australia. Consecrated on 30 November 1854 and made D.D. *per literas regias*, he reached Sydney on 25 May 1855. As metropolitan he found four dioceses besides his own—Tasmania, Melbourne, Adelaide, and Newcastle—under his jurisdiction: to these during his primacy he added Perth (1856), Brisbane (1859), Goulburn (1863), Grafton and Armidale (1866), Bathurst (1869), Ballarat (1875), and North Queensland (1878). The system of state aid for religious denominations, which had been in existence since the early days of the settlement, was abolished in 1863—except to the then recipients—by a 'Grants for Public Worship Prohibition Act,' and Barker at once set about the preparation of a constitution for the Church of England in Australia. In 1866 he secured the passing of an act to give the Church power over its own property, and on 5 December of that year was in consequence able to preside over the first diocesan synod of Sydney. He succeeded further in establishing a general synod of the whole Anglican Church in Australia, which met three times during his primacy. In his own diocese his unceasing work was of the greatest value; St. Andrew's cathedral was completed and consecrated, rural deaneries were established, Moore College was founded at Liverpool, New South Wales, for the education of candidates for holy orders, a church buildings loan fund and a Church Society were formed, and the work of the parochial clergy was made easier and more effective both by the primate's intimate supervision and encouragement and by the financial assistance which he procured from the laity. During his episcopate 236 churches were erected in the diocese. In 1881, being attacked by paralysis, he visited England and the French Riviera, but died at San Remo on 6 April 1882. See CHURCH OF ENGLAND.

Barkly, SIR HENRY (1815-1898), was the only son of Aeneas Barkly, a West India merchant, and on leaving school entered his father's business. In 1845 he was returned to parliament as member for Leominster, but in 1848 took the governorship of British Guiana, where he had large estates, and began a career of nearly 30 years as professional governor—of Jamaica 1853-6, Victoria 1856-63, Mauritius 1863-70, the Cape Colony 1870-7. It is not easy to understand why he was appointed to Victoria, as his special qualification was an intimate knowledge of the requirements and conditions of coolie labour which made his terms of office in Guiana, Jamaica and Mauritius particularly valuable: but his Victorian career, which coincided with the first seven years of the 'responsible government' regime, was markedly successful, partly because he followed a governor (Sir Charles Hotham, q.v) who had seemed to leading colonists deficient both in social qualities and in economic and constitutional knowledge, partly because he handled with sagacity and tact several important constitutional problems which were bound to crop up at the beginning of the new regime. The experience he gained in Australia proved extremely useful when at the Cape of Good Hope he again found himself helping to introduce responsible government, and at the same time being pressed by an over-enthusiastic secretary of state to force a system of federation on the South African colonies.

From the personal point of view Barkly's governorship is chiefly notable for his political self-effacement; he was in that respect the beau-ideal of a constitutional governor. It was also a remarkably progressive epoch in the history of Victoria; it included the construction of the first two main railway lines—from Melbourne to Bendigo and from Geelong to Ballarat—the des-

patch of the Burke and Wills (q.v) exploring expedition, drastic reforms in the prison system, the founding of the national art gallery and the national museum, and the establishment in Melbourne of permanent gas and water supplies. In all these matters Barkly was much interested, and his active support appreciably aided their completion. Gyles Turner describes him at this time as follows:—'A tall, handsome man, of cultivated tastes, with a considerable store of scientific knowledge and a thorough grounding in the principles of political economy and constitutional law . . . . His services were always readily available in public movements having philanthropic aims . . . . and his speeches on such occasions were invariably thoughtful in substance and happy in form.'

At the close of his term at the Cape he retired on a pension, and spent the remainder of his life in literary and scientific pursuits. In 1864 he had been made F.R.S., and in 1870 F.R.G.S.; and during eight years of his retirement he took an active part in the administration of the latter society. He died in London on 20 October 1898. (K.C.B., 1853; G.C.M.G., 1874).

Barley. The production of barley within the Commonwealth fluctuates considerably from year to year; thus in the five seasons 1916-21 the acreage under crop varied from as low as 205,000 acres to as high as 335,000, while the yield per acre varied from 16 to 21 bushels. Since 1914 South Australia has been the chief barley-producing State. Ninety per cent of its yield is used for malting, but in Victoria, which has the next highest yield and acreage, little more than half the crop is thus used. The Queensland figures are usually almost negligible (though their variation is extreme) and those of the other States taken together show barely an eighth of the South Australian yield. The greater part of the crop supplies the home market; small quantities are exported to the Straits Settlements and to New Zealand. Malting barley is in normal years entirely consumed at home; but in 1917-8 (during the stress of the German submarine campaign), and in 1920-1, a good deal was exported to Japan, the Philippines and South Africa. During the last two years for which figures are available (1921-2 and 1922-3) the average yield for the Commonwealth was 6¼ million bushels (5 millions malting) from about 325,000 acres; of this crop about 2,100,000 bushels were exported. These figures do not include the acreage grown for hay and green forage.

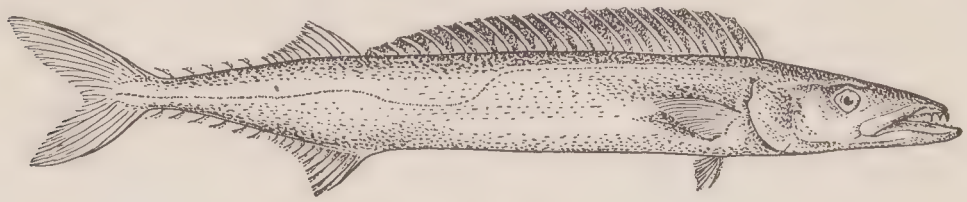
W.S.C.

Barney, GEORGE, (1792-1862), born in London on 19 May 1792, entered the army when only 16 (2nd lieutenant, 1808; 1st lieutenant, 1809; 2nd captain, 1813; 1st captain, 1825; lieutenant-colonel, 1840), and served in the garrison of Tarifa (1811) and at the taking of Guadeloupe (1815). Then for nearly 20 years he was attached to a detachment of engineers in the West Indies, and rose to command it. Employed for a short time on improving the defences of Portsmouth, he was in July 1835 chosen to inaugurate a new system of public works construction in New South Wales. Up to that time all public works in the colony had been designed and constructed in a somewhat haphazard fashion, under the supervision of such persons as the local authorities might think expert enough: but in 1834 Governor Bourke, confronted with the need for more elaborate harbour works at Sydney and Newcastle than had hitherto been found sufficient, proposed the appointment of a civil engineer. The British government had already decided to station in New South Wales a branch of the ordnance department to construct and control buildings belonging to the military or the convict department, and soon afterwards chose Captain Barney for the command of this branch. Early in 1836 Bourke suggested that Barney should also undertake the duties of civil engineer, and arranged with him in advance to clear a channel in the Parramatta River and inspect the Newcastle breakwater: in February 1837 he added to this list the construction of the series of wharves in Sydney Cove now known as Circular Quay, the formation of pier harbours at Wollongong and other coastal ports, and the general supervision of roads and bridges. Approval was reluctantly extorted from the department in London, but Barney took over the work Bourke asked of him without waiting for approval, and even busied himself with the building of an engine for a North Shore ferry-boat. At the same time he devised plans for 'putting the Principal Seaports of this Country in a State of Defence against desultory attacks from Foreign Cruisers.' In the colony, it should be noted, he was always known officially as Major Barney—probably to give him precedence over captains in the infantry regiments stationed there—although in the royal engineers of those days the rank of major was unknown. He designed the Victoria barracks at Paddington, Sydney, and was first chairman of the Australian Gaslight Company. In April 1844 he returned to England in order to take over the engineer command at Woolwich; but when Gladstone determined to establish a new colony in North Australia he chose Barney—probably as a man used to rule, who knew something both about Australia and about convict discipline—for the colony's first lieutenant-governor. Appointed on 25 May 1846, Barney reached Sydney on 15 September, and almost at once set out in the little *Cornubia* to examine the coast-line of his new domain, which commenced at lat. 26° S. The story of his selection of Port Curtis and of the settlement which he began to found there is told under GLADSTONE COLONY. When Earl Grey, succeeding Gladstone as colonial secretary, reversed his decisions and ordered the abandonment of the colony, Barney returned to his position at Woolwich, but soon retired from the army, came back to New South Wales, and on 1 January 1849 was made chief commissioner of crown lands. In October 1851 he became a member of the legislative council, but retired on the introduction in 1856 of responsible government. He was surveyor-general from 11 October 1855 to 13 August 1859; resigning that post, he lived in Edward-street, North Sydney, until his death on 16 April 1862.

Barracouta, a southern circumpolar fish (*Thyrsites atun*) occurring in the waters of New Zealand, Tasmania, and southern Australia, South Africa and South America; it occasionally ranges northwards to the latitude of Port Jackson. It is very elongate (sometimes four feet in length), with flattened sides and a large oblique mouth armed with powerful teeth. Its colouring is brilliant silver on the sides and steel-blue on the back, while the dorsal fin is ornamented with a broad black margin. The name 'barracouta' is a corruption of that of a West Indian fish, the barracuda—a very different species, allied to the Sea-pike (*Sphyraena*) of Australian waters. Bar-

racouta provide fine sport for fishermen, who catch them with a large hook concealed in a brightly coloured rag and trolled behind a boat. They are commonly infested with round-worms, which at times almost completely fill the intestinal tract. These do not affect the value of the fish as food; but it is not regarded as a high-class fish even when in its best condition, though smoked barracouta finds a ready sale in the markets.

The King Barracouta (*Jordanidia solandri*) was first discovered in New Zealand waters by the naturalist Charles Solander, who accompanied Cook on his first voyage to Australia. It was among a number of fishes purchased from the Maoris, and, being three feet in length and obviously good eating, was served up with the rest to satisfy the demands of the ship's company for a variation of their diet of pickled pork. Before reaching the cook's hands, however, it was carefully described by Solander, in a note-book which was later deposited in the British Museum. His manuscript notes were subsequently examined by Cuvier and Valenciennes, who recognized the affinities of the fish with the rare gempyllids, and therefore named it *Gempylus solandri*. The



Barracouta.

species was not again recognized until 1882, when it was taken in Tasmanian waters in great abundance; it was afterwards found off the southern coasts of Australia and in New Zealand waters; a very similar species was obtained in Japan, and its genus was named *Jordanidia* after the greatest of modern ichthyologists, David Starr Jordan. The king barracouta is an excellent food-fish, and may attain a length of three feet, though its usual size is considerably less. It occurs in shallow waters on the cooler Tasmanian coasts, but descends to a greater depth as it extends northwards, being trawled in over 100 fathoms off Port Jackson. It is commonly known in Tasmania as 'kingfish.' A.R.McC.

Barrallier, Francis Luis (1773-1853), of French descent but son of a surveyor in the service of the admiralty, was born in 1773 and while still a young man attracted the attention of C. F. Greville (a prominent politician of the day), who in 1799 recommended the Duke of Portland (then secretary for the colonies) to make him deputy-surveyor-general of New South Wales when that office should become vacant. Portland refused to commit himself in advance, but suggested that Barrallier should proceed at once to the colony so as to be on the spot. Accordingly he sailed with King in the *Speedy*, reached Port Jackson on 15 April 1800, and on 2 July in a general order issued by Hunter was commissioned ensign in the New South Wales Corps; the commission was dated 14 August. His work, however, was concerned with scientific rather than with military tasks; his first job was the designing of a building for the Parramatta orphan asylum, and in March 1801 he was sent with Grant in the *Lady Nelson*, nominally as officer commanding a small guard, but really to help Grant in surveying harbours, etc.; the charts then made of Jervis Bay, Western Port, and Bass Strait (from Cape Northumberland to Cape Howe) were mainly or entirely Barrallier's work. In a second trip (June-July) he mapped the Hunter almost up to Greta and the Williams almost to Dungog. It is remarkable that in his maps the name 'Hunter' is given to the Williams, the Hunter above Raymond Terrace being called 'Paterson.' In recognition of his services King made him engineer and artillery officer of the corps. In October 1802 an unfortunate misunderstanding between King and Paterson led to the temporary withdrawal of Barrallier from all but military duties; King, however, who was planning an exploration of the ranges west of the Nepean and needed Barrallier for it, solved the difficulty by appointing him on 18 October 'aide-de-camp to the governor,' so that his duties were thenceforward fixed by King and not by Paterson. Of the explorations he then undertook an account will be found under Exploration by Land; for many years it was believed that he had crossed the main range and discovered some tributary of the Lachlan, but it is now known that he never crossed the watershed, though he reached it. During his Sydney career he also designed a fort on Observatory Hill which is now the signal station, and made the plans for the first vessel built in Sydney (see Shipping).

But in spite of King's subterfuge Barrallier found the divided allegiance irksome, and in May 1803 resigned his commission in the corps and returned to England in H.M.S. *Glatton*, sailing on 17 May. Thenceforward he followed the regular course of a regimental career (lieutenant, 1805; captain, 1809; major, 1831; retired on half-pay, 1833; brevet lieutenant-colonel, 1840), but was for the most part employed on survey and engineering work, chiefly in the West Indies. From 1812 to 1817 he was employed on an elaborate survey of Barbados. After retirement from the service he settled in London, and died there on 11 June 1853.

Barramundi, a remarkable fish (*Scleropages leichhardti*) first discovered by the explorer Leichhardt in the Burdekin River, Queensland. It is remotely related to the herrings, and is of very ancient lineage, belonging to the family Osteoglossidae, which comprises a small group of freshwater fishes from South America, Africa, Malaysia, and northern Australia. To the same family belongs the great arapaima of Brazil, the largest of freshwater fishes; this attains a length of 15 feet and a weight of over 400 pounds, and is highly valued as food. The Australian fish does not grow above three feet in length, and its dry flesh is so beset with a wall of needle-like ribs as to be scarcely worth the trouble entailed in eating it. The body is greatly compressed, and the head is covered with large flat plates, whereas the scales are very large and thick.

The name barramundi is applied in Queensland to several of the larger freshwater fishes, and in particular to the present species, the Giant Perch (*Lates*) and the Lung-fish (*Epiceratodus*). 'Burramundi' and 'barramunda' are variant spellings. A.R.McC.

Barrier Reef, THE GREAT. Perhaps the most remarkable geographical feature of Australia is the Great Barrier Reef, the largest deposit of coral in the world (the next in size being the Barrier Reef of New Caledonia). Between the extremes of Bramble Cay and Lady Elliot Island, from 9° S. lat. to 24° S. lat., the Barrier Reef stretches 1200 miles. Towards the north it hugs the shore almost within sight of land, but its southern section slants seaward till it is 150 miles away. It is probably built along a foundered coast-line, for beyond it the sea-floor suddenly plunges to great depths, while within it the water is only a few fathoms deep. Northwards its margin is composed of banks a few miles in length, separated by intervals of a mile or so; only a few (the broader) of these channels are charted. As it extends into southern latitudes, the lower temperatures become less and less favourable to coral growth, so that it gradually breaks up into small scattered clusters of reefs, the last of which nearly coincides with the tropic of Capricorn.

The whole of this area is notorious for the dangers and difficulties that beset shipping. Hurricanes occur as far south as latitude 16°, and few summers pass without disaster to vessels and ports. The northward-flowing tide, once inside the line of reefs, is squeezed between them and the mainland till it reaches heights unknown farther south; at Broad Sound, for instance, the spring tides have a range of 30 feet. As the Barrier Reef draws in towards the land, the ship-channel becomes increasingly narrow and crooked; between Cooktown and Thursday Island the route is so difficult that it can be navigated only by day, and under the guidance of a pilot. On the other hand, the outer reefs act as a huge natural breakwater to shelter the coastal waters. From the deck of a vessel within the Barrier the tremendous surf on the outside edge is a magnificent spectacle. Far out of sight of land, and with no apparent cause, a line of boiling surf springs suddenly out of the blue ocean, and runs from one horizon to the other as an unbroken ribbon of dazzling foam. The space between the mainland and the outermost reefs is thickly strewn with islands of two types. In the first group are the coral islets or atolls, whose recent formation can be recognized, as far away as they are visible, from their flat contour; of the other type are the lofty mountain islands of granite or palaeozoic rock, fragments of a former coast-range which existed when the land stood at a higher level. Their chain extends so continuously that for several hundred miles each is in sight of at least one other. Often they are grouped in clusters, some rocky and barren, others clothed with forests of pine and palm. It is islands of this type that make the beauty of the Whitsunday Passage and the Hinchinbrook Passage, winding channels regularly traversed by coastal steamers that pass under towering peaks, among a maze of islets and harbours, where streams cascade through tangles of green foliage to beaches of yellow sand.

The Great Barrier is not a single reef, but an aggregate. The individual reefs that compose it are coral banks of all shapes and sizes—submerged, awash, or topped by a pile of sand, shingle and shrubbery. So inaccessible are these reefs that ordinary travellers or residents on the mainland never see them. Along the actual coast-line the sea is too much muddied with the discharge of rivers to be endured by the coral, which luxuriates in the clear warm water several miles off shore. This, indeed, may be one explanation of the seaward slant already referred to; it is the outflowing waters of the Herbert, Burdekin, and Fitzroy that push the reefs farther away from dry land. When a reef is neared, the first indication of coral may be the appearance on the horizon of a long, low, level block, representing an islet, often covered with plant life. If the reef be covered at high tide, the roar of the surf on the windward side calls a warning. On the sheltered side a sudden change occurs in the colour of the water, from deep dark-blue to vivid emerald-green. It is this change of colour that gives the watchman at the masthead his best warning of a coral shoal-patch. The exposed side of a reef is studded with storm-tossed lumps of coral, varying from the size of a table to that of a haystack, the taller projecting even at high water. At a distance these 'negro-heads,' as they are called, are magnified by mirage, and look like tombstones in a cemetery.

Earlier writers represented a coral reef as resulting from the intelligence of the coral 'insect,' that planned its reef as a bee might construct its honeycomb. Actually the coral animal is a polyp, not an insect, and is not intelligent. It is an animated piece of jelly, which only differs from the sea-anemone by unconsciously forming lime as the human body unconsciously forms bone. Indeed, the animal contribution to a coral reef is chiefly the production of the raw material, lime; the shaping into reef form is mainly done by the mechanism of wind and waves. A reef is not exclusively composed of coral; it is rather a framework of coral, in which all manner of other animals and plants occur. Only at the lowest spring-tides are the fields of living coral exposed to the air. At other states of the tide the living edge of the reef, as seen from a boat through clear water, is a wonderful sight—a sort of landscape whose brilliantly-coloured vegetation has been turned to stone. The coral masses assume the aspect of tufts of heather, or of gigantic mushrooms, or of elegant vases. A general tone of browns or yellows is brightened by dashes of vivid blue or orange, pink or purple. Instead of soft green foliage, there are strewn among the coral endless varieties of animal life, many quaintly shaped and richly coloured. Here and there are giant clams, said to be capable of breaking a man's leg. At low-water the clams gape, and display myriads of eyes like golden beads set in plush or velvet. Sea-urchins are there, with sharp, poisonous spines as long as knitting-needles. There are starfish of many forms, a common one being sky-blue; others have long snake-like arms that writhe about. If one of these be handled, it throws off first one arm and then another till it is completely dismembered. There is a huge brown sea-anemone as big as a dinner-plate, whose broad bosom is the refuge of a small fish coloured brilliant scarlet with a white bar. Lying on the sand in shallow pools are many kinds of bêche-de-mer; in shape like a great sausage, in colour black, brown or yellow, they spread their circle of feelers, and mop up and swallow indiscriminately a mass of sand and weed on the chance that it may contain food.

That part of the reef which is exposed by ordinary tides is not beautiful at all. It consists of banks of sand and piles of dead, discoloured and broken coral. Every storm tears off masses of coral from their roots, flings them on the beach, and grinds them to sand—the sand of such a beach is yellower than ordinary sand, because of the multitude of foraminifera it contains. The beach is often paved with slabs of coral-sand-rock, the petrified core of a former sand-heap. After the wind has sifted and stacked the sand, rain dissolves lime from the surface strata and, re-depositing it farther down, cements the loose grains into solid rock. When another gale strips the cover, stone has replaced the sand. New land is made when sand and shingle are piled high enough to be dry at high tides. Drift or bird-carried seeds take possession, and the spot grows green with shrubs and herbs. The drift flora of a coral strand is a peculiar assemblage, unknown elsewhere, of plants of any kind whose seeds, immune to the poison of salt, are adapted for flotation. As soon as shelter from the surf is obtainable, a colony of mangroves rises from the mud on tall stilt roots. The sand-beach is fringed with a screen of slender willowy *Casuarina*. Over the scorching sand, just out of reach of the waves, trail the long vines of an *Ipomoea*, with a large red flower and leaves shaped like a cloven hoof. The quaint *Pandanus* bears fruit like a wooden pine-apple, and tufts of long, saw-edged leaves set in screws. *Tournefortia* has a round top of beautiful silvery foliage, and the Queensland laburnum decorates the beach with clusters of bright yellow blossoms. The one tree that the visitor expects to find on a coral island—the coco-nut palm—is never seen in this region, except where it has been introduced. Towards the interior of the islet there is often a dense, cool forest of low trees. A sand-bank thrown up four years previously was found by E. J. Banfield (q.v.), a resident on one of the inner islands, to support more than 40 different kinds of herbs and shrubs.

So seldom do men intrude on these lonely islands that myriads of sea-fowl choose them for a refuge. Flocks of birds stream so densely off them as to resemble sometimes a volume of smoke rising from a bush-fire. Several kinds of turtle—the green, the logger-head and the hawksbill—resort in early summer to the coral islets to lay their eggs in the sand, while dugong graze on the seaweed on the flats in sheltered water.

The wide space of warm, smooth, shallow water enclosed by the Great Barrier Reef is rich in economic products. Pearling (q.v.) is the oldest and the largest business of the Barrier fisheries. The variety that yields the pearls of Ceylon is not taken here, being replaced by larger kinds, the black-lip and the golden-lip—the latter the largest pearl-shell in the world. It is the mother-of-pearl shell, rather than the contained pearls, that forms the staple of the industry; it is exported to be manufactured into knife-handles, buttons and similar articles. The headquarters of the trade is Thursday Island, which commands the rich and extensive grounds of Torres Straits. But valuable, though smaller, fields occur for several hundred miles southwards. The pioneers, gathering the shell that lay exposed on the reefs at low-tide, reaped a rich harvest; as these deposits were exhausted, the search was extended into deeper water by expert native swimmers and divers; then, with the aid of pumps and diving helmets, shell was gathered from still greater depths. So many deaths resulted from work at the limit of human endurance that the law prohibited diving on the deepest beds. From time to time the beds have been stripped to the margin of profitable collecting, but have recovered after a few years' rest.

Bêche-de-mer fishing is another lucrative industry; it produces a harvest worth from 14 to 40 thousand pounds annually, and employs a corresponding number of men and boats. The bêche-de-mer (otherwise called the trepang, sea-cucumber or sea-slug) is a soft, cylindrical animal, sometimes as thick as a man's wrist, which crawls about on coral reefs. An unpleasant habit of voiding the viscera when handled has given it the additional name of 'cotton-fish.' A great number of different kinds are gathered for the market, and there are other species of no commercial value. The 'fish,' as they are called, are picked up at low-tide by men who dive for them in shallow water; they are prepared for export by being boiled alive, gutted and dried—after which the product resembles a crumpled lump of leather. The Chinese, who make it into excellent soup, are the sole consumers.

A smaller industry of recent growth is that of Trochus gathering. Trochus (often spelt 'trocas') is a snail which inhabits a sea-shell like a huge periwinkle, of nacreous substance and pyramidal shape, four inches in diameter, and coloured with broad red and white stripes. Preparation consists merely of gathering the shell on the reefs and ridding it of the snail. The trade is chiefly in the hands of the Japanese; they export from five to ten thousand pounds' worth annually to Japan, where factories are equipped with elaborate machinery for cutting the shell into 'pearl' buttons.

Both green and 'tortoise-shell' turtle are plentiful, but have not as yet been commercially exploited. Dugong (q.v.) are caught for food by the aborigines. No sponge fishery has been established, but 'hard' or second grade, though marketable, sponges are known to occur, and further search may probably discover a superior 'soft' article.

There has been much theorizing about the formation of the Great Barrier Reef. Since raised reefs are unknown in this area, it is plain that elevation has not occurred. Agassiz argued that neither elevation nor depression had happened, and that the Barrier had grown under stationary conditions; but the evidence that he advanced has been denied by subsequent observers. It is generally agreed that the reef has been built up during a period of slow and continuous subsidence. A crumpling inwards of the land has produced both large submergence and a slight emergence. In harmony with this theory are the steep seaward foundation of the reef: the sunken coast-range, whose peaks now form islands in the channel: the intricate dissection of the mainland into bays and capes, the drowned river-mouths of the Queensland coast, and the break-down of an isthmus that once spanned Torres Straits. As regards the evolution of the features in detail, it has been shown that the growth of an individual reef proceeds in a regular cycle. If the axis of the reef, when it reaches the surface, lies along the direction of the prevailing wind, its shape endures; if it lies across the wind, the ends are produced backwards, forming first a crescent, later a horseshoe, and lastly an oval, thus enclosing a lagoon. Then the lagoon walls broaden; the lagoon itself is filled up with sediment; a sandbank spreads on the summit and

is covered with vegetation; and the atoll, grown to a cay, has arrived at maturity. C.H.

Barrington, GEORGE (1755-1804), born at Maynooth in Ireland on 14 May 1755, was the son of Henry Waldron, and the name by which he is now always known was merely assumed at the age of 16 for theatrical purposes. He was evidently a bright boy, for a local physician undertook his early education, and a dignitary of the Irish Church sent him to school in Dublin and expected him to enter the university. In 1771, however, he ran away from school and as 'Barrington' joined a strolling company of players; the manager taught him the gentle art of picking pockets, and very soon he crossed the Channel to London and pursued his trade there in the disguise of a clergyman. He first attracted public notice when in April 1775 he was charged at Bow-street with having robbed Prince Alexis Orloff of a gold snuffbox worth £40,000; but, as Orloff recovered the box from him and did not trouble to appear in court, he could not be convicted. Later on, being caught picking a woman's pocket at the theatre, he was sentenced to three years' hard labour on the hulks at Woolwich; good conduct procured his release within 12 months, but he was caught again and given five years; the eloquence of his speech from the dock induced a well-meaning person to procure his release again, on condition he left the country; within a few weeks he was caught once more and given a year in Newgate, and stood in the dock again in February 1784 (acquitted), April 1785 (acquitted), January 1787 (broke gaol, was attainted and outlawed); became a 'racecourse pest' at Glasgow, Carlisle, Derby, and Newcastle; was in the dock again in December 1789 (acquitted); and on 15 September 1790 was tried at the Old Bailey for picking pockets on a racecourse, and on this occasion sentenced to seven years' transportation. By this time his numerous trials and remarkable acquittals had made him a notoriety; *The Times* in 1794 used him in a satire on Jacobinism as 'Citizen Barrington, Representative from Botany Bay,' and any Fleet-street hack with a melodramatic tale to sell could double his price by attributing it to George Barrington.

King on his way to Norfolk Island saw Barrington in the convict-transport *Active* at the Cape, and reported that he was 'now a religious convert; he performs service and gives a sermon twice on Sundays.' On arrival in Sydney he continued this conduct; Phillip used him as a watchman at the Toongabbie barracks, found him diligent, sober, impartial, and 'eminently serviceable'—to quote Collins—and on 3 November 1792 emancipated him within the colony (he was one of the first three so treated) and granted him 30 acres near Parramatta. Hunter praised him highly and on 17 September 1796 made him chief constable and superintendent of convicts at Parramatta; when he resigned this post in November 1800, he was allowed half-pay as a reward for good service. In 1801 he was said to be a mere living skeleton, emaciated and almost without intelligence, and when towards the end of 1804 (the exact date is disputed) he died, he was officially described as a lunatic.

Round this remarkable person legends of all kinds have accumulated. The facts stated above are authentic from 1775 onwards; the story of his early life is taken from the one book a share in which may with some probability be assigned to him—*A Voyage to New South Wales*, published in London in 1795, with a dedication written (allegedly) at Parramatta in 1793. This passed through many editions, and was translated into French; the greater part of it was probably written up in London from the works of Phillip, Collins and Tench. The other works bearing his name—which are listed as his even by the *Dictionary of National Biography*—are indubitably not his. The famous prologue which he was supposed to have written for the first theatrical performance in Australia is discussed below. W.J.

Barringtonia, a genus of the family Myrtaceae, chiefly tropical, consisting of trees whose habitat is usually a river-bank or seashore. The two species indigenous to Australia are also found throughout Malaysia, and one is common in India. The calyx-tube is ovoid; petals 4-5, adhering at the base to the staminal cup; stamens numerous in several series, joined at the base into a ring or cup; fruit pyramidal, ovoid, or oblong, hard and fibrous; leaves alternate. The fruit is eminently adapted for dispersal by ocean currents, as its inner coat is a layer of fibrous tissue, the interstices forming air-spaces which make for buoyancy. The outer coat is varnished and waterproof. *B. speciosa* is a large tree with big showy flowers. In Fiji the outer portion of its large 4-angled poisonous fruits is used to catch fish by stupefying them. Its timber is yellow, tough and firm, and is useful in cabinet work.

'Barrington' Prologue, THE. In almost all works published during the last 120 years that deal, however incidentally, with the Australian drama, reference has been made to a famous Prologue supposed to have been either written by George Barrington for, or spoken by him at, the opening of the first Australian theatre in 1796. About twenty years ago, however, Alfred Lee, a well-known Sydney bibliophile, discovered the Prologue in a book (described below) which was previously unknown. This book passed with the rest of Lee's collections into the possession of David S. Mitchell (q.v.), and is now in the Mitchell Library at Sydney. Bertram Stevens announced the true source of the Prologue in the *Native Companion* of 30 March 1907.

In 1802 F. and C. Rivington of St. Paul's Churchyard, London, issued a small volume of *Original Poems, and Translations . . . . chiefly by Susanna Watts.* Susanna belonged to the old Leicestershire family of Watts, and was a near relative of Alaric Watts, poet, critic, and founder of the *Standard* newspaper; and her book was advertised as 'sold by all the Booksellers in Leicester.' On p. 84 of this volume occurs the first known draft of a poem described there as follows:

> The Newspapers having announced, that a Theatre was to be opened at Sydney Town, Botany Bay, and Plays to be performed by the Convicts, this Prologue is supposed to have been spoken by the celebrated Mr. B-rr-ngt-n, on that occasion. 1801. By a Gentleman.

To those acquainted with eighteenth century humour the phraseology of this introduction is evidence enough that the poem is avowedly a *jeu d'esprit*, the offspring of some witty gentleman in Susanna's circle: and a pencilled note in the Mitchell Library copy gives the author's name as 'Hy. Carter Esq.'—several other poems in the book being similarly noted as his. The title-page of the book is also backed with a note to the effect that none of its contents had

been ever published before. If further proof is needed that the prologue appeared then for the first time, the date attached to it may be considered decisive. A newspaper announcement of the opening of a Sydney theatre, if made in 1801, could refer only to the second theatre established in 1800 (see DRAMA); and it has never been suggested that the 'Barrington' prologue was connected with this theatre. Furthermore, among the other verses attributed in the Mitchell Library copy to Henry Carter are four more prologues for plays, and two other poems in heroic metre which repeat or adapt phrases from the 'Barrington' prologue. Thus a poem entitled 'The Flight to Paris'—written in January 1802, obviously in anticipation of the rush of British tourists to Paris that occurred as soon as the Peace of Amiens was made—ends with the wish:—

May future Tourists . . . .
Stem Dissipation's wide o'erbearing flood,
And turn their travels to their *Country's Good!*

The Carter authorship may therefore be considered established. Henry Carter, it may be added, died on 30 August 1806, and his obituary notice in the *Gentleman's Magazine* describes him as 'a gentleman of considerable literary attainments and great benevolence.'

Good though it was, the jest would have sunk into undeserved obscurity had not an enterprising publisher in 1802 conceived the idea of attributing to 'the celebrated Mr. Barrington' a *History of New South Wales* the greater part of which is stolen from Collins. While he was stealing, he stole also the Carter prologue, improved several of the couplets, omitted the Shylock couplet (which could not possibly have been spoken in the alleged circumstances), and on pp. 152-3 of the *History* inserted the new version as a prologue spoken at the 1796 opening. It is not there definitely asserted to have been spoken, or even composed, by Barrington; but its occurrence in a book supposed to have been written by him was basis enough for the further attribution to him of both its authorship and its first delivery. It may be noted (*a*) that in the 1801 editions of the *Voyage to New South Wales* (see BARRINGTON, GEORGE), which contain an account of the 1796 opening almost identical with that of the *History*, there is no mention of a prologue; (*b*) that the 1802 *History* version of the Prologue was in the second (1810) edition still further emended, and brought into the form in which it has ever since been reproduced. Below are printed two versions—Carter's original poem, and the 1810 revision.

From *ORIGINAL POEMS*, 1802.

From distant climes, o'er wide spread seas we come,
(Though not with much eclât, or beat of drum)
True patriots all; for be it understood,
We left our country for our country's good;
No private views disgrac'd our generous zeal;
What urg'd our travels, was our country's weal;
And none will doubt, but that our emigration
Has proved most useful to the British nation.
But you enquire, in us whence springs this rage,
"To strut and fret our hour upon the stage?"
Could aught lift, within our former practice, teach,
Talents like ours, dramatic fame to reach?
List, list, Oh list, before this Court I plead,
Our claim well founded to Theatric meed.
He, who to midnight ladders is no stranger,
You'll grant will make an admirable *Ranger;*
To seek *Macheath* we have not far to roam,
And sure in *Filch* I shall be quite at home;
Unrival'd there, none will dispute my claim
To high pre-eminence, and unequal'd fame.
As oft on *Gadshill* we have ta'en our stand,
"When 'twas so dark, you could not see your hand,"
Some true-bred *Falstaff* we may hope to start,
Who, when well-bolster'd, well will play his part.
The scene to vary, we shall try in time,
To treat you, now and then, with Pantomime;
Here light and easy Columbines are found,
And well-try'd Harlequins with us abound;
From durance vile our precious selves to keep,
We oft had recourse to the flying leap;
To a black face have sometimes ow'd escape,
And Hounslow-heath has prov'd the worth of crape.
But how, you ask, can we e'er hope to soar
Above these scenes, and rise to tragic lore?
Oh! we have forc'd, too oft, th' unwilling tear,
And petrify'd the heart with real fear;
Macbeth a harvest of applause will reap,
For some of us, I fear, "have murder'd sleep."
His *Lady*, too, with grace, will dream and talk;
Our females have been us'd at night to walk;
While *Shylock*, thirsting to extinguish life,
With ready hand will whet the murderer's knife:
Sometimes, indeed, so various is our art,
An actor may improve and mend his part;
"Give me a horse," bawls *Richard*, like a drone;
We'll find a man would help himself to one.
Grant us your favour, put us to the test;
To gain your smiles we'll do our very best,
And, without dread of future Turnkey *Lockits*,
Thus, in an honest way, still *pick* your *pockets*.

From *HISTORY OF NEW SOUTH WALES*, 1810 edition. (Principal alterations in lines 9-14, 20, 26, 30, 35, 39; lines 41-2 omitted.)

From distant climes, o'er wide-spread seas, we come,
Though not with much eclat, or beat of drum:
True patriots all; for, be it understood,
We left our country, for our country's good;
No private views disgrac'd our generous zeal,
What urg'd our travels was, our country's weal;
And none will doubt, but that our emigration
Has prov'd most useful to the British Nation.
But, you inquire, what could our breasts inflame
With this new passion for Theatric fame;
What, in the practice of our former days,
Could shape our talents to exhibit plays?
Your patience, Sirs, some observations made,
You'll grant us equal to the Scenic trade.
He, who to midnight ladders is no stranger,
You'll own will make an admirable Ranger.
To seek Mackheath we have not far to roam,
And sure in Filch, I shall be quite at home.
Unrivall'd there, none will dispute my claim
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And, without dread of future turnkey Lockits,
Thus, in an honest way, still pick your pockets.

Barron, SIR HARRY (1847-1921), son of Charles Robert Barron of Denmark Hill, London, was born on 11 August 1847, educated at Tunbridge Wells and Woolwich, and in 1867 entered the royal artillery (lieutenant, 1867; captain,

1879; major, 1884; lieutenant-colonel, 1894; colonel, 1898; major-general, 1904). From 1897 to 1900 he was chief instructor of the school of gunnery at Shoeburyness, and was then given command of the royal artillery in the Thames district, taking a similar position at Malta in 1904. When he retired from active service in 1909, he was made governor of Tasmania, and transferred in 1913 to Western Australia. In 1917 he retired from this position also, and spent the rest of his life quietly at Weybridge in Surrey, receiving in 1920 the position of colonel commandant in the royal artillery. He died on 27 March 1921. (C.V.O., 1907; K.C.M.G., 1909).

Barry, Alfred (1826-1910), born in London on 15 January 1826, and educated at King's College, London, and Trinity College, Cambridge (B.A., 1848; M.A., 1851; B.D., 1860; D.D., 1866; D.C.L., 1870), distinguished himself both in mathematics (4th wrangler and 2nd Smith's prizeman, 1848) and classics (7th in 1st class of classical tripos) and was made a fellow of Trinity. He took orders in 1850 (priest, 1853), but until 1871 devoted himself to educational work, being vice-principal at Glenalmond in 1849-54, headmaster of the Leeds grammar school in 1854-62, principal of Cheltenham College in 1862-68, and principal of King's College, London, in 1868-71. In 1871 Gladstone made him a residentiary canon of Worcester; in 1875 he became honorary chaplain to Queen Victoria, and in 1879 chaplain in ordinary; in 1881 he was, again by Gladstone, made a residentiary canon of Westminster Abbey. In 1876 he refused the bishopric of Calcutta, but in 1883 accepted that of Sydney, and was consecrated in Westminster Abbey on 1 January 1884.

He was, however, never at home in Australia. His active and highly intellectual mind faced boldly, but with a good deal of distaste, the crude conditions and comparatively petty problems of colonial administration, and his clergy found the value of his guidance, great though it undoubtedly was, somewhat diminished by a too apparent lack of sympathy. In a five years' term he managed to include several visits to England, and in 1889 resigned the see and returned to England for good. His absence had injured his chances of further preferment, and for the rest of his life he was never more than an official or unofficial assistant to English bishops. Thus he was assistant to the bishop of Rochester in 1889-91, locum-tenens for the bishop of Exeter in 1891, and (as rector of St. James, Piccadilly) assistant to the bishop of London in 1895-1900. In 1891 he was made a canon of St. George's chapel at Windsor, and from 1900 to the day of his death—1 April 1910—confined himself to the duties of that position. He was a powerful orator and a sound administrator, but his literary work—except that which embodied the substance of his Boyle lectures (1876-8) and Hulsean lectures (1894)—was not of outstanding merit.

Barry, Sir Redmond (1813-1880), born at Ballyclough near Cork in Ireland was the third son of Major-general Henry Green Barry. Educated at Trinity College, Dublin (B.A., 1833; LL.D., 1876), he was called to the bar in 1838 and the next year migrated to Sydney, going on almost immediately to the young town of Melbourne. There in 1841, when branches of the New South Wales supreme court and court of requests were established, he was appointed commissioner of the latter court. At first he lived in a small cottage fronting the lane just west of the Bourke-street synagogue; in or after 1843 he moved a little farther west to a larger (5-roomed) cottage close to Goldsborough's woolstore; and in both houses he seems to have set aside one room for a public reading-room, supplied with standard works and many current English magazines, to which he invited anyone who had not a home of his own to spend his evenings in. The action symbolized his whole life, which was devoted, to the utmost of his power, to promoting the educational and artistic growth of the community he lived in. When in 1851 Victoria became a separate colony, Barry was made solicitor-general and given a seat in the council; in 1852 he was promoted to the supreme court bench, and remained there till his death in 1880, acting as chief justice on several occasions and (for a few days) as administrator of the government in 1876-7.

His greatest services to Victoria, however, lay in another direction. 'Though not a man of deep learning himself,' says Gyles Turner, 'he had been above all others the means of bringing both learning and learned men to the colony . . . . The University, the Public Library, and the National Gallery were his foster-children, and for their advancement he worked with unceasing activity.' (*History of Victoria*, ii. 222.) These were 'the invaluable services' commemorated on the pedestal of his statue in front of the Melbourne public library. Childers and Latrobe inaugurated the movement for establishing a university, but Barry's was the persistent and considered zeal that nursed it to maturity; he was its first chancellor, and retained the position till his death. The library owes him no less, and he was rightly made the first president of its trustees; his work in this respect was so valued that during a visit to England in 1877 he was made vice-president of a great conference of librarians, at which he read important papers. He was a commissioner for Victoria at both the London international exhibition of 1862 and the Philadelphia centennial exhibition of 1876. He died in Melbourne on 22 November 1880. (Kt. Bach., 1860; K.C.M.G., 1877.)

Barry, Shiel. See Donohoe, Andrew.

Barton, Sir Edmund (1849-1920), born at the Glebe, Sydney, on 18 January 1849 and educated at the Sydney Grammar School and the university of Sydney (B.A., 1868; M.A., 1870), was called to the New South Wales bar in 1871 and became a Q.C. in 1889. Preferring politics to law, he contested the university seat unsuccessfully in 1877 and successfully in 1879; but in that year university representation was abolished, and Barton became successively member for Wellington (1880-1), East Sydney (1882-7 and 1891-4), and the Hastings and Macleay (1898-9), interpolating two terms (1887-91 and 1897-8) as a member of the legislative council. From 1883 to 1887 he was speaker of the legislative assembly, and might have been premier when he left the chair, but for a certain constitutional laziness that more than once hampered his career. Partly because he believed in protectionist tariffs, partly from distrust of Henry Parkes, he attached himself to George Dibbs, then leader of the opposition, and when that leader came into office was his attorney-general in the 1889 ministry, as well as (for a time) in that of 1891-4. But by that time Barton's whole outlook upon local politics had altered. From the commencement of the final movement towards federation he abandoned all minor interests to devote himself

to that cause. In the 1891 convention he was one of the representatives from New South Wales, and one of the four members chosen by the convention to draft the constitution bill; later in the year he stood (and was elected) for East Sydney as a federationist, and joined the Dibbs ministry explicitly as the leader of the federal movement in New South Wales—a position which he took up at the direct request of Sir Henry Parkes. The dual position, however, proved impossible; though in 1892 he carried through the assembly a pro-federal resolution, he found (to use his own words) that certain colleagues were 'always strewing tacks in my path;' and in December 1893 he resigned office on a personal question in order to regain full freedom for carrying on outside the cabinet the campaign for the 1891 bill. Unfortunately that campaign was already moribund. New South Wales was for the moment interested solely in the fight between freetraders and protectionists, which raged with all the greater fury because George Reid, the new freetrade leader, was advocating a drastic system of land taxation. Nevertheless Barton maintained a persistent attack on the popular mind by a series of addresses—nearly 300 in four years—designed to explain the principles of the 1891 bill. He was never a really popular speaker, and the addresses fell flat as far as the public was concerned, the agitation for federation during those years being revived by different means (see FEDERATION); what he did achieve was to attract and inspire a number of young men, most of them from the various universities, who when the great effort of 1897-9 was being made became missionaries of the idea throughout Australia, and looked up to him all the while as their hero.

When the Quick proposals of 1894, as modified by the Hobart enabling bill of 1895, at last found fulfilment in the federal convention elections of 4 March 1897, Barton headed the poll for New South Wales with nearly 75 per cent of the total votes polled, and when the convention met was without difficulty made 'leader of the Convention' and chairman of a constitutional committee. This body at once appointed him chairman of the sub-committee that drafted the new bill, and the Commonwealth act, though much trimmed and partly re-shaped in the various meetings of the convention and by the British authorities, owes a good deal to his work. When the period of conventions was over and the referendum campaign began, Reid's notorious 'Yes-No' attitude made the thorough-going Barton more than ever the leader of the eager federalists; the campaign proving at last successful, he was made the New South Wales delegate to London to help the Commonwealth bill through the Imperial parliament, and when the process was complete and the first governor-general reached Australia, it was expected everywhere that he would at once be made prime minister. An obscure intrigue, however, which was directed towards making Sir W. Lyne prime minister first astonished and then angered the public, and ended ignominiously. The men who, as everyone knew, must be included in the first federal cabinet would serve under no one but Barton; he therefore took the prime-ministership along with the department of 'external' affairs (i.e. the relations of Australia with the mother-country and with other nations through her)—and almost at once, under the influence of one of his recurring fits of laziness, dropped out of active politics and allowed his subordinates to go their several ways. His one personal contribution to federal policy was unfortunate; it was the naval agreement of 1902 (for which see NAVAL DEFENCE), which reduced Australia's share in the defence of the Empire to a mere subsidy of the admiralty, and did much to lose seats for many of his supporters in the elections of 1903. Before then, however, Barton had left politics for ever, retiring in September 1903 to the dignified seclusion of the high court bench, where he was quite overshadowed by the brilliant energies of Sir Samuel Griffith and was apparently content to be known as the embodiment of the court's 'concurrent' jurisdiction because he almost invariably concurred in the bigger man's judgments. The history of his later years, except where it was interrupted by severe illness, is a record of honoured but on the whole inactive serenity. He died at Medlow on the Blue Mountains (N.S.W.) on 7 January 1920.

One of the great names of modern Australia, Barton was not actually a great man, though he easily might have been. The cause of federation alone was near enough to his heart to make him work really hard; and, just because he never worked really hard for any other object, he lacked the experience of popular needs and feelings that made far less able politicians far more effective advocates. To the cause of federation he made two invaluable contributions—the legal and constitutional skill which moulded the instrument of government, and the inspiration (born of his high ideals, his unselfish aims, his lovable character) which he afforded to the young missionaries already spoken of. (P.C., 1901; G.C.M.G., 1902.)

Barytes occurs almost all over the Commonwealth, but has been obtained for commercial purposes chiefly in South Australia, which in the three years 1920-22 produced 8231 tons. In 1920 Tasmania produced 1000 tons (no later production is recorded), and in 1920-1 New South Wales produced 622 tons. Willunga in South Australia is the chief centre of the industry; it has extensive deposits, in veins varying from two to seven feet in thickness, of mineral of good quality but slightly discoloured by iron. Large deposits, still unworked, are known to exist in Victoria and Western Australia.

Basking Shark (*Cetorhinus maximus*), one of the largest of recent sharks, attaining a length of 35 feet. Notwithstanding its great size, it is quite harmless to man, and feeds upon minute floating animals, which are evidently strained from the water by means of peculiar comb-like structures upon the gill-arches. It is said to be sluggish, and derives its vernacular name from a habit of floating almost motionless near the surface of the sea; at such a time it perhaps collects the drift-life which forms its food. It ranges over all temperate seas, and several large specimens have been taken in southern Australian waters. The teeth are very small, weak, and numerous, about 200 being in each row. Another characteristic feature lies in the great size of the gill-openings. The basking shark is sometimes sought for the oil contained in its liver, of which a large quantity is obtained from each individual; its capture is not unattended with danger, since a blow from the tail of a large specimen is sufficient to stave in the sides of a whaleboat.

A.R.McC.

Bass, GEORGE (1763-1808?), son of a Lincolnshire farmer, was born at Aswarby in that county; but on his father's death the family moved to the neighbouring town of Boston, and

the boy was apprenticed to a local surgeon. Obtaining his diploma in London, he was established by his mother as a village apothecary in his native county; but the passion for a seafaring life which had sprung up in him as a boy could not be suppressed—he abandoned his shop, and obtained a commission in the royal navy as surgeon to H.M.S. *Reliance*, which on 15 February 1795 left Plymouth for Australia. She carried Governor Hunter; she carried also—as a midshipman, not as a passenger—Matthew Flinders.

Between Flinders and Bass, both Lincolnshire men, there sprang up during the voyage a firm and long-lasting friendship. Twenty years later, when they had been long separated, Flinders narrates with a sort of fiery pleasure his first acquaintance with 'a man whose ardour for discovery was not to be repressed by any obstacles, nor deterred by danger,' and accompanies almost every reference to his companion in many dangerous explorations with epithets of affection and eulogy. No sooner were the two young men in Port Jackson, and at liberty from the ship's routine, than they began a career of adventure that has left its mark on Australian history. The detailed story of their explorations will be found under EXPLORATION BY SEA; but it may be said here that they included (*a*) a journey up George's River in a boat eight feet long with a 5-ft. beam, (*b*) a journey down the coast almost to Lake Illawarra, in a slightly bigger boat, (*c*) after an interval during which the *Reliance* was sent to South Africa to fetch back live stock, Bass's famous voyage in the whaleboat to Western Port, (*d*) Flinders's trip in the *Francis* to the Furneaux Islands, (*e*) the Bass-Flinders circumnavigation of Tasmania in the *Norfolk*. Of these the whaleboat voyage was at the time particularly and deservedly renowned; Péron in 1802 writes that the boat itself was preserved on the foreshore of Port Jackson 'with a kind of religious respect,' and souvenirs were made from its timbers.

Nor was Bass's adventurous spirit content with exploration by sea. In June 1796, after the Illawarra voyage, he attempted the piercing of the Blue Mountains barrier, but failed because he used the European method of working up the valleys, so that as soon as he climbed to the top of a ridge—by following which he could have anticipated Blaxland's achievement—he carefully and futilely let himself down again into the impassable gorge below (see EXPLORATION BY LAND). And in 1797, just before the whaleboat voyage, he discovered veins of coal at Coalcliff in northern Illawarra, and made a walking tour from Sydney to the Cowpastures and thence due east to the sea. It was possibly for the discovery of coal that Hunter gave him 100 acres at Bankstown; for the grant was made before the whaleboat voyage was completed.

In May or June 1799 Bass returned to England—why or how we do not know—and is next heard of as marrying, in October 1800, the sister of his old commander Waterhouse. Early in the following year a small (142-ton) brig, the *Venus*, sailed from England to take up trading in the South Seas, with Bass as managing owner and supercargo, acting on behalf of a syndicate of friends and relatives. She reached Sydney on 28 August, and was almost immediately employed in fetching salt pork from Tahiti and salt from Hawaii. Even in commercial work, however, Bass remained adventurous; after two Tahiti voyages pork could not content him—he contracted with Governor King to buy a government brig that had been wrecked on Tahiti, proposed to him a 7-year lease of the southern coast-line of New Zealand in order to establish there fisheries on a large scale, and enlarged his plans for a third trip to Tahiti by adding one to Peru in search of guanacoes. For this purpose King gave him a certificate showing that he was engaged on public business 'without any view to private commerce or any other view whatsoever.' He sailed from Sydney on 5 February 1803: and that is all we know.

It is worth noting that he still ranked as a naval officer, and in 1803 made an official report, as 'navy surgeon,' on the health of Lieutenant-governor Paterson. It must also be remembered that Péron, in 1802, was very alarmist about designs of the British government on Spanish Peru, and alleged that both by piratical attacks on Spanish vessels and by supplying arms and ammunition to the rebel Chileans Britain hoped to expel Spain from South America. In these circumstances it is not difficult to conjecture that the arrival of a British merchant vessel, commanded by a naval officer, in a Peruvian port might give rise to suspicions which even King's certificate could not altogether dispel; and we need not surmise that Bass was in reality trying to run a trade in contraband (the arguments for this surmise will be found in Scott's *Matthew Flinders*, pp. 149-54; those against it in the *Historical Records of Australia*, I., iv. 669-70). Early in 1805 the master of a British vessel, the *Harrington*, which had been privateering off the South American coast, reported that the *Venus* had been captured by the Spaniards and Bass sent as a prisoner to the mines inland; this is quite in accord with the rough and ready procedure of colonial governments in those days, and may be accepted as true. King, it should be noted, at the end of 1804 was still 'in constant expectation of hearing' from Bass, but after the arrival of the *Harrington* does not again allude to him. A rumour quoted (without acceptance) in the *Historical Records* which makes him still alive in South America in 1817 is too vague and unsupported to need closer consideration. Indeed, there are reasons for believing that he died in or before 1808.

Of Bass's appearance and character we know a good deal. He was six feet in height, handsome, dark, with very keen eyes (several friends use the word 'penetrating' in connection with his look). Flinders, who knew him most intimately, kept up a correspondence with him after their separation, was gravely disappointed when they missed each other in 1802-3, and submitted his own work to his friend's criticism with obvious respect as well as affection. Hunter had a high opinion of him. And his own doings and writings show him alert, resourceful, courageous, impatient of inactivity, and at the same time modest and unassuming beyond the normal—a man, that is, who wanted to get things done and rightly done, and was not much troubled about getting the credit for having done them.

Batchelor, EGERTON LEE (1865-1911), born at Adelaide on 4 April 1865 and educated at the North Adelaide public school, in 1877 became a pupil-teacher there, but in 1882 entered the locomotive workshops of the South Australian railways as an apprentice, and rose to be foreman. In 1889 he joined the Amalgamated Society of Engineers (in which later on he was four times president of the South Australian branch), and in 1891 left the workshops to enter politics. In 1893 he was elected senior

member for West Adelaide in the assembly, and held the seat until 1901, with C. C. Kingston (q.v.) as his junior colleague for 6½ years. He was also secretary of the South Australian Labour party until 1898, when he was chosen its leader. In December 1899 he joined the coalition ministry of F. W. Holder (q.v.) as minister of education and agriculture, but resigned in 1901 to enter the Commonwealth parliament, in which he was for a time the only Labour member from South Australia. In 1903 he became federal member for Boothby, and retained the seat until his death. In the Watson ministry of 1904 he was minister for home affairs, and minister for external affairs in the Fisher ministries of 1908-9 and 1910-11. In 1911 he accompanied Andrew Fisher to the Imperial Conference of that year, but shortly after his return from England died suddenly of heart failure at Warburton near Melbourne on 8 October. An obituary notice in *The Times* emphasized both the friendships he had made among British statesmen and 'his sound common sense and cool judgment' in the debates of the Conference.

Batfish, tropical fishes (*Platax*) which swim in small schools, and are widely distributed throughout the Indian and Pacific Oceans. They are rounded and sometimes deeper than long, and the body is greatly compressed; the anterior rays of the dorsal and anal fins are so greatly lengthened in the young that they trail backwards as pointed lobes, giving the fish a crescent shape. They alter considerably in appearance with growth, however, and it is often difficult to associate the young with the adults. The upper and lower processes of the vertebral column commonly develop large bony bosses; these, though apparently normal, have been supposed to be the result of disease, and one species has even been named *Platax arthriticus* in the belief that it was affected with arthritis. The Silver Batfish (*Monodactylus argenteus*) is an allied species of similar habits and distribution. It is common on Australian coasts, extending southward to Sydney.

A.R.McC.

Bathurst, Henry (1762-1834), 3rd Earl Bathurst, born on 22 May 1762, and educated at Christ Church, Oxford (where he matriculated in 1779, but in accordance with the custom of the time took no degree), during his youth contracted an intimate friendship with William Pitt the younger, who made him in 1783 a lord of the admiralty, in 1789 a lord of the treasury, and in 1790 a teller of the exchequer; this last office he held till his death. In 1793 he entered parliament as member for Cirencester, but vacated the seat in the following year because, owing to his father's death, he had become a member of the house of lords. When Pitt formed his second ministry in 1804, he offered Bathurst the mastership of the mint; Bathurst refused, not feeling himself entitled to such high office, but Pitt insisted. After Pitt's death he was president of the board of trade under the Duke of Portland and Spencer Perceval (1807-12), as well as master of the mint, and for a few months in 1809 was also foreign secretary. Lord Liverpool, who became premier after the assassination of Perceval, made Bathurst secretary for war and the colonies; this office he held until 1827, and from 1828 to 1830 was lord president of the council under the Duke of Wellington, with whom he had had intimate and satisfactory dealings during the latter part of the Peninsular war. He was, indeed, the best and most intelligent, if not the ablest, of all the war ministers with whom Wellington had to deal. A Tory of the old school by conviction, he yet favoured Catholic emancipation and the abolition of the slave trade, but could not abide parliamentary reform, and after the passing of the reform act of 1831 abandoned politics altogether. He died on 27 July 1834.

Bathurst's interest for Australia centres on his long administration of the colonial office. In the earlier years of it, when he was engaged in helping Wellington to win the war, he trusted a good deal to Henry Goulburn (q.v.); as the post-war ferment decreased and military affairs receded into the background, he began to take a personal interest in New South Wales affairs. In 1816 he supported Macquarie's action against the Bents, and his letters thereanent betray the personality of a strong and sober patriot, concerned rather with the public advantage than with technical points or personal prejudices. In 1817 he discussed at length the exploration of the interior, and insisted on the continuation by P. P. King of Flinders's surveys along the coast. During the same year, however, he took occasion thrice at least to censure Macquarie for undue severity—trusting, apparently, to accusations backed by Samuel Marsden. Macquarie promptly tendered his resignation, and Bathurst's reply of 18 October 1818 is a model statement of what should be the relations between a good governor and a good colonial secretary. Even when in 1819 he sent out J. T. Bigge, he definitely gave Macquarie permission to disregard the commissioner's wishes, though he naturally deprecated such a course. It might have been better if his first intention (expressed in his letter of 23 April 1817 to Lord Sidmouth, then home secretary) of appointing several commissioners had been carried out; for it was clearly Bigge's personality, not Bathurst's desires, that brought about the somewhat troubled close of Macquarie's rule. Bathurst, as his letter to Sidmouth and his farewell letter to Macquarie (10 September 1822) show, was concerned about the new conditions imposed on the colony by an excessive influx of convicts rather than about any supposed misdeeds of Macquarie's.

His correspondence with Brisbane strengthens the impression already formed of his good sense and loyalty to his officials. He adopted Bigge's recommendations in the main, but gave Brisbane—who was on the spot and could bring a fresh judgment to bear—full discretion to postpone any of them and supply the office with further information on the subject. Once again he showed an inclination to take anything Marsden said for gospel, but proved open to conviction. The one fault he would not pardon—as in the brothers Bent, so in Brisbane and Frederick Goulburn—was personal jealousy that impeded the public service; and he objected also to governors who, while shifting to his shoulders the responsibility of important action, did not aid him to the utmost extent with their expert advice. Thus he rebuked Darling in 1826 for forwarding a report from Archdeacon Scott without having taken time himself to examine the recommendations minutely and with acquired experience. In fact, everything we know of him depicts him as a statesman of unfailing good sense, not brilliant in parliament, but all the better suited to administer a great department; conservative, philanthropic, devoted to the public interest, but preserved by an unfailing sense of humour from the ponderous officialism that too often handicaps British statesmen. (K.G., 1817.)

Batman, JOHN (1800-1839), born at Rose Hill (now Parramatta) in 1800 and educated locally—he was a schoolfellow of Hamilton Hume (q.v.)—was the eldest son of William Batman, a settler who reached New South Wales in 1797 and soon became a member of the circle of pious men who gathered round the missionaries from Tahiti (see OAKES, REBECCA). John was brought up to the blacksmith's trade, but in 1821 left New South Wales to settle in Tasmania at Kingston in the Fingal district on the flanks of Ben Lomond. In 1826 he made himself notable by capturing singlehanded the dangerous bushranger Matthew Brady, and in 1828-30 made himself useful to Governor Arthur by his tactful and humane handling of the natives during and after the so-called 'Black War.' Meanwhile he had formed a close acquaintance with J. T. Gellibrand (q.v.), and in 1827 joined him in a proposal to establish a settlement at Western Port, which Darling, then governor of New South Wales, refused to entertain. At that time, it should be remembered, it was still supposed that the fine country through which Hume and Hovell passed towards the end of their famous journey was on the shores of Western Port. In 1831, however, Dr. Bland disclosed to the public what Hovell himself had known since 1826—that the explorers had reached the western shores of Port Phillip; Batman's hopes were therefore transferred to that district, and in 1834 he proposed to some friends the colonization of the yet untouched area without seeking any governor's permission in advance. (It is extremely probable, at the same time, that Arthur knew of the proposals and approved them; but as governor of Tasmania he had no status in the matter, Port Phillip lying within the colony of New South Wales.) According to one of his associates, Batman then declared that he had gathered his information about the area to be settled from Hume personally; but this is doubtful. In any case an association was formed there and then, Batman and Gellibrand being its most active members, and the other 13 including Arthur's nephew Henry; Gellibrand drew up formal deeds of conveyance—for the rights of native owners were to be strictly respected—and on 10 May 1835 Batman left Launceston in the schooner *Rebecca* with three white men and six aboriginals of some New South Wales tribe. Not till the 26th could he clear the Tamar heads, and it was two days more before he could leave the Tasmanian coast, but by midday on the 29th the *Rebecca* was anchored near Indented Head. Two days were spent in exploring south and west of Corio Bay (the area, be it remembered, of which Hume had given such glowing accounts); then the *Rebecca* was brought up to Yarra mouth and anchored off the bar, and Batman made a sweeping march up the Saltwater River, round past Sunbury, and down towards the Plenty. Near this stream he met a tribe of natives, and seized the opportunity to obtain the signatures of their camp-council to the deeds drawn up by Gellibrand; he had met no other adult males since his landing, and was quite ready to assume that they owned the whole territory and could, as 'chiefs,' grant it away. (This grant is more fully discussed under VICTORIA.) The documents once signed, he hurried back to Tasmania—after a brief inspection of the lower Yarra, for which see MELBOURNE, and the establishment of an occupying party on Indented Head—reached Launceston on 11 June, and by the 25th had with Gellibrand's help prepared a memorial asking for confirmation of the purchase and promising a definite scheme of colonization; this was signed by all the members of the association. Arthur could not hold out much hope, but sent the memorial on to London with a strong recommendation that something should be done for Batman.

Meanwhile another party had taken a hand in the game. The story of John Pascoe Fawkner's settlement on the Yarra will be found under FAWKNER and MELBOURNE. Here it need only be mentioned that his party deliberately settled down along the Yarra at the head of tide-water (on land previously visited by Batman and claimed by him under the purchase-deeds), maintained their position in spite of a formal notification given them by J. H. Wedge, one of the association, and were in the end allowed by the British government to purchase at a reduced rate the sites they had actually occupied. The Batman camp at Indented Head was at once moved to the Yarra, and by the middle of September both parties were ensconcing themselves on 'Batman's Hill' (on which the Melbourne law-courts now stand). Fawkner himself arrived on the Yarra on 10 October, and Batman on the 26th; the latter proceeded to mark out his personal share of the great purchase—a block extending from the Saltwater to the Plenty and about 15 miles northwards from the Yarra settlement. But already his plans had been annulled. Governor Bourke on 26 August proclaimed the purchase void and all white residents of Port Phillip intruders and trespassers; he had no intention, probably, of taking any active steps against them, but his proclamation put them outside the law, prevented them from establishing any sort of title to any land, and left the situation entirely in his own hands whenever he obtained from England authority to do anything. This he at once asked for; Batman's proceedings, he told the authorities in London, could not establish a lasting and law-abiding colony, but it might be advisable to make an official settlement at Port Phillip under the usual conditions, and so bring the new arrivals under proper legal control. In April 1836 approval was given to these proposals, and in September William Lonsdale reached Port Phillip and took charge as superintendent of the settlement. Batman had earlier in the year (about April) transferred his permanent home from Tasmania to Port Phillip and built a house on land, just outside the south-western corner of the settlement, which he claimed under his grant from the association. Here he lived for three years, although in June and November 1837 he purchased eight lots inside Melbourne at the official land-sales; but the government would give him no title to the outside area, repeated appeals failed to procure for him any substantial concession, and, even when the British colonial secretary expressed the opinion that he should be allowed the value of his improvements, the New South Wales government would only allow him to remove to another site the materials of the house and other movable property. Before this concession was obtained Batman died on 6 May 1839, and in the end the administrator of the settlement bought the cottage for £200. Australian pioneers have often suffered misfortunes, but few have been treated so harshly by their fellow colonists in official positions as was John Batman.

Batrachia. See AMPHIBIA.

Bats, an order (*Chiroptera*) of mammals comprising two sub-orders—the Megachiroptera

or fruit-eating bats ('flying foxes') and the Microchiroptera or ordinary bats, the great majority of which feed exclusively on insects. Both sub-orders are well represented in the Australian region. Of flying foxes there are seven Australian species; by far the most widely distributed is the Grey-headed Flying Fox (*Pteropus poliocephalus*), which frequents New South Wales, southern Queensland and parts of Victoria. It is distinguished from other species of *Pteropus* by the bright reddish-yellow colour of the fur on the neck, shoulders and fore-part of the breast, that on the back being greyish-black and on the head grey with a yellowish tinge. The Dusky Flying Fox (*P. brunneus*), which is yellowish-brown all over, has hitherto been found only on the Percy Islands, off the Queensland coast. Gould's Flying Fox (*P. gouldi*) is black all over, except for a brown patch on the back of the head and neck (the neck-patch in adult males is sometimes bright yellow); it is widely distributed in northern Queensland and on the islands off that coast. The Spectacled Flying Fox (*P. conspicillatus*), with a ring of pale brownish-yellow round each eye, also occurs in northern Queensland, but extends across Torres Straits to Yule Island in Papua. The Collared Flying Fox (*P. scapulatus*), which has a pale band round the neck, is another northern Queensland species. *Nyctimene papuanus* and *N. robinsoni*, which occur in north-eastern Queensland, are smaller than the ordinary fruit-eating bats, and have projecting tubular nostrils.

The smallest of all the fruit-eating forms, said to be exceptionally destructive, is the Little Flying Fox (*Syconycteris australis*) which has a very wide range—from western and northern Australia through the Malay Archipelago to the Philippines, as well as in New Ireland and the Solomons.

Of Microchiroptera, the ordinary insectivorous bats, Australia possesses a large number of species, belonging to many genera and several families. The great majority of Australian bats are not known to occur outside the region, and some are limited to particular parts of Australia; but a few have a wider range—two are found in Europe, and one in Africa. Of the two species that occur in New Zealand one is found also in south-eastern Australia. The most abundantly represented family is the Vespertilionidae; it consists of bats devoid of the elaborate nostril appendages present in the other families. The genus *Nyctophilus* is peculiar to the Australian region, taking the place occupied in northern lands by *Plecotus*—the genus to which the British long-eared bat belongs. The nine species of *Nyctophilus* have a wide range, extending over continental Australia, Tasmania, and the islands to Fiji on the east. The Little Bat (*Eptesicus pumilus*), which is only 1½ inches long and has black fur both above and below, is also widely distributed in Australia and Tasmania, but does not extend beyond the boundaries of the Commonwealth. The Yellow-headed Bat (*Pipistrellus abramus*), which is a little larger, extends from northern Australia to the Malay Archipelago, southern Japan, and Ceylon, and in summer is found in central Europe. A larger species of the same genus—Krefft's Bat (*P. tasmaniensis*)—inhabits New South Wales and Tasmania. The Chocolate Bat (*Chalinolobus morio*), widely distributed in extra-tropical Australia, is the species referred to above as extending to New Zealand; it is figured on plate xi. Other common species are Gould's Bat (*C. gouldi*) of eastern and south-eastern Australia and Tasmania, the Pied Bat (*C. nigrogriseus*) of northern and eastern Australia, Rüppell's Bat (*Scoteinus rueppelli*) of New South Wales, and the Great-footed Bat (*Leuconoë adversa*) which extends from Siam through Java, Borneo, and Celebes to northern Australia. The family Rhinolophidae, in which the nose is provided with leaf-like appendages, is represented by four Australian species. In the Greater Horseshoe Bat (*Rhinolophus megaphyllus*), of Queensland and the northern rivers of New South Wales, a part of these appendages assumes the form of a horseshoe. The Great Blood-sucking Bat (*Macroderma gigas*), which has only been found in the Wilson's River district of central Queensland, belongs to a genus of wide distribution in Asia and Africa, the members of which feed not on insects alone, but on smaller bats, other small mammals, and other vertebrates. The head and body have a length of over five inches.

See Dobson, *British Museum Catalogue of the Chiroptera* (1878); Gould, *Mammals of Australia*; Ogilby, 'Catalogue of Australian Mammals' in *Australian Museum Catalogue*, No. 16; Lucas and Le Souef, *The Animals of Australia;* Andersen, 'Megachiroptera' in *British Museum Catalogue of the Chiroptera*, vol. i (1912).

W.A.H.

Bat's-wing Coral. See ERYTHRINA.

Baucra, a genus of the family Saxifragaceae, endemic in Australia, consisting of three species of shrubs. The calyx is divided to the base into 6-10 spreading segments, often toothed; stamens inserted round a narrow disk; fruit a capsule opening in two valves; leaves opposite, each divided into 3 leaflets attached to the branch horizontally by their bases, giving the impression of a whorl of 6 leaves. *B. rubioides* (Native Dog-rose) is a scrambling shrub, usually found near a watercourse; in the blooming season it is covered with pink flowers. The flowers of *B. capitata* are terminal. *B. sessiliflora* is confined to the Victorian Grampians.

Bauhinia, a genus of the family Leguminosae, consisting of trees or woody climbers, chiefly tropical. The leaves are divided into two distinct leaflets, or united into an entire or 2-lobed leaf. *B. Carroni* (Queensland Ebony), the 'pegunny' of the Cloncurry River natives, is a small tree with a light-brown, heavy wood suitable for veneers. *B. Hookeri*, a large tree, also known as Mountain Ebony, has a similar timber.

Bayley, ARTHUR. See GOLD, DISCOVERY OF.

'Beagle,' H.M.S. See EXPLORATION BY SEA.

Beardie. See COD.

Bêche-de-mer. See ECHINODERMATA.

Becke, GEORGE LEWIS (1855-1913), better known as 'Louis Becke,' was born at Port Macquarie in New South Wales on 18 June 1855 and educated locally and at Fort-street school in Sydney. At the age of 14 he was sent by an uncle to California to learn trading in the employ of a San Francisco firm; the voyage, which was made over devious routes, took 130 days, and the boy was enchanted by glimpses of island life. Soon after his arrival in America he left San Francisco to work in a coastal trader, and at 16 shipped aboard a vessel engaged in catching sharks off Christmas and Palmyra islands. For a time he was em-

ployed as supercargo in an island trader: then (in 1874) he revisited Australia, spent two years on the newly discovered Palmer goldfield in Queensland, and was employed for a short time by the Australian Joint Stock Bank's Townsville branch. But the Pacific had too strong a hold on him: by 1879 he was back in Samoa, and during a visit to the Marshalls met the notorious 'Bully' Hayes, with whom he worked for some years as supercargo. During the eighties he traded in practically every Pacific island group from the Gambiers to the Pelews—an area covering 100 degrees of longitude by 35 of latitude—everywhere welcome, but nowhere really successful. In 1893 he found himself in Sydney, none too well off, and took some stories of island life to J. F. Archibald (q.v.), then editor of the *Bulletin*, who encouraged him to write more and helped him with the writing; in 1894 a collection of these stories was published in London under the title *By Reef and Palm*. This was the first and best of a long series of novels and short-story collections dealing with the southern Pacific, many of which were written in collaboration with Walter Jeffery: *The Mutineer* (1898) which dealt with the 'Mutiny of the *Bounty*' (q.v.) was probably the best of these. Jeffery also collaborated with him in *Naval Pioneers of Australia* (1899). From 1897 to 1907 he resided in England or France, but in 1908 returned to the Pacific, living for a time at Suva in Fiji, then in New Zealand, and at last drifted back to Sydney, where he died on 18 February 1913.

Bedford, Sir Frederick George Denham (1838-1913), son of Vice-admiral E. J. Bedford, was born on 28 December 1838. He entered the royal navy in 1852, served in the Black Sea and the Baltic during the Crimean war, and became lieutenant in 1859, commander in 1871, and captain in 1876. He commanded the *Shah* in her engagement with the Peruvian ironclad *Huascar* in 1877, and as captain of H.M.S. *Monarch* in 1884 organized an armed flotilla to operate on the Nile for the relief of General Gordon. From 1889 to 1892 he was a lord of the admiralty; between 1892 and 1895 he had charge of naval operations against native chiefs on the west coast of Africa, then returning to the admiralty until 1899, and becoming commander-in-chief on the North American station until 1903. In that year he was appointed governor of Western Australia, and held the post until 1909. He died at Weybridge in Surrey on 30 January 1913. (C.B., 1886; K.C.B., 1895; G.C.B., 1902; G.C.M.G., 1909.)

Bedfordia, a genus of the family Compositae, two species of which are endemic in Australia. Its floral bracts are in a single row; disk pitted; florets without rays; fruits angular, with a pappus of slender bristles. *B. salicina* (Tasmanian Dogwood), also known as 'Cottonwood' owing to the abundant down on the leaves, is one of the few members of the family which yield a commercial timber. The wood is pale-brown and mottled, and is used for furniture. It emits a foetid smell when cut, and is exceptionally difficult to season. Fresh shavings change colour in a remarkable manner. The under-side of the leaves yields a white flock (about 1 oz. from 1 lb. of green leaves) which is obtained by means of a stiff brush or blunt knife.

Beech. This name is erroneously applied to several Australian trees, notably to *Gmelina Leichhardtii* (q.v.). The only true Australian beeches are three species of *Nothofagus* described under that heading. For the so-called brown beech see Cryptocarya; for colonial beech, Nothofagus; for evergreen beech, Cupuliferae; for Indian beech, Pongamia; for mountain beech, Lomatia; for negrohead beech, Cupuliferae or Nothofagus; and for white beech, Gmelina or Phyllanthus.

Bee-eaters. See Kingfishers and Bee-eaters.

Bee Farming. The honey bee (*Apis mellifica*) occurs in most parts of the world, but the forms found in different countries exhibit slight differences of appearance and behaviour. These some entomologists consider as distinguishing species, while others class all the forms as mere races or sub-species of *A. mellifica*.

The first reference to bees in Australian history occurs in a letter from Gregory Blaxland (1 March 1805), asking for cargo space on the *William Pitt* for a 'swarm of bees in cabin with wire cage over the hive.' There is, however, no record of their safe landing. The first record of the actual introduction of bees occurs in a letter from Samuel Marsden to the secretary of the London Missionary Society, in which he mentions that on his way back to the colony in the ship *Ann* he purchased at Rio de Janeiro two hives, which were safely landed on 27 February 1810, and placed in the garden of government house. In March 1822 Captain Wallace of the *Isabella* brought in a number of hives, and the first swarming is recorded as taking place in the following October. These 'black' or 'English' bees have since spread over the entire continent, and are now locally known as the 'bush' bee. The Italian race (*A. mellifica*, var. *ligustica*) was introduced between the years 1874 and 1878, and the so-called 'hybrid' is a cross between the black and the Italian races. The Italians, and even the hybrids, have shown themselves so far superior to the black bee as honey-makers that the great majority of bee-keepers consider all discussion of the matter at an end. Italians—where the race is still pure and not enfeebled by interbreeding with light-coloured bees—are superior to any other kind, and may be safely recommended to those who propose to keep bees, either as a commercial proposition or merely as a hobby.

Australia, with its widespread eucalypt-forests, offers an excellent field for bee-farming; for eucalyptus flowers provide both nectar and pollen in abundance, and from them nearly all our honey is obtained. Other important honey-producing plants are the prickly pear—which now overruns large areas in Queensland and New South Wales; lucerne (especially on river flats in New South Wales, where it is raised for seed); and the clovers, which are chiefly grown in Victoria and Tasmania. Another widely-distributed group of trees—the wattles, or acacias—although not nectar-yielding, supply large quantities of pollen in the early spring, when the bees most require it for the purpose of rearing their broods.

City flower-gardens, though of no use to the bee-farmer on a large scale, help the town-dweller with his one or two hives; most garden flowers yield nectar and pollen, but it takes a large area of plants to provide a really adequate supply. Near the cities, however, 30 or 40 lb. per bee-colony is considered a fair return. The most productive garden-flowers are the Labiatae

(rosemary, thyme, lavender, and salvia), as well as stocks, lupins, sunflowers, gaillardias, mignonette, honeysuckle, freesias, and lilies.

From the rich and varied Australian flora very large yields of honey are often obtained, of which the apicultural journals contain authentic records; a Victorian grower obtained 824 lb. and 807 lb. from two hives, exclusive of the weight of honey removed when uncapping.

Victoria is the only State that has any legislation dealing with bee-pasture. The forest department administers the act. A bee-farm site is an area (up to 10 acres) on which to place the bees. A bee range is an area of a mile radius (with the bee-farm in the centre) to be used as a foraging ground. The bee-farmer rents the tops of the trees only; he has no right over the grass or land. In the other States a prospective bee-farmer, after deciding on a suitable district, generally purchases or rents a small area on which to place his hives, extracting house, etc., after previously ascertaining (in his own interests) that he is at least two miles from any other apiary. To prevent horses or cattle from molesting the bees, it is advisable to fence the area. But, if sheep are grazing in the neighbourhood, it is a good plan to let them have free range of the apiary, to keep down the grass.

The methods of securing a honey crop may be obtained from textbooks dealing especially with Australian conditions. One or two points of general interest, however, may be mentioned. Owing to the genial climate the bee-farmer can dispense with the elaborate precautions—such as winter packing, chaff hives, and underground cellars—that are required in colder countries. Here the bees can remain on their summer stands, though spare supers should be removed, and the hive-entrances made smaller. In a district liable to frosts a few thicknesses of newspaper, placed on the frames under the mat, will keep the bees snug and warm. In early summer bees exhibit a tendency to swarm, which must be restricted to the utmost, as it divides the strength of a colony just when it is most wanted. With care and attention to modern methods swarming can be greatly reduced, if not altogether prevented. When the swarming impulse ceases, the bees settle down to steady work, and the bee-farmer, relieved of much worry, is able to devote more time to the commercial side of his business.

The old idea that bee-farming is easy, and that the farmer has only to wait until the hives are full of honey and then extract it, has gone by the board. Modern appliances have simplified work in the apiary, but have also increased it, and have both enabled and compelled the apiarist to deal more scientifically with his business.

The native bee (*Trigona*) produces a honey with very distinctive qualities, alleged by some naturalists to be antiseptic and anti-malarial. At one time it was bought up for exportation to France, and there realized from two to three shillings per pound, one small consignment even reaching 4s. 6d. When properly separated from the cells in which it is stored, *Trigona* honey is exceptionally delicious. But native bees must not be kept near hives of any imported species, as they at once devote themselves to robbing their neighbours instead of collecting their own supplies. If kept well apart, they are assiduous honey-makers, and their small size (not greater than a house-fly's) allows them to visit many sources of nectar that the larger imported species leave alone.

The returns of honey from productive hives during the 1922-3 season (the latest available) gave an average of 58¼ lb. per hive. The reported yield of 1917-8 averaged nearly 76 lb., but this was abnormal: the probable explanation is that, when in 1917 the price of honey suddenly doubled, quantities of previously stored honey were put on the market and so found their way into official statistics. In 1919-20 the yield was very low, but 1920-1—judging by a fairly long average of years—may be taken as normal. The figures for the last four seasons yet published are:—

		HONEY.		BEESWAX.	
		Product	Exports	Product	Net imports
1919-20	(Amount, lb.)	3,144,280	588,384	60,435	10,296
	(Value, £.)		18,815		502
1920-21	(Amount, lb.)	5,651,143	97,541	78,181	20,700
	(Value, £.)		5,328		1,642
1921-22	(Amount, lb.)	7,370,790	94,471	84,417	221,182
	(Value, £.)		4,448		12,362
1922-23	(Amount, lb.)	6,369,062	57,638	90,494	238,368
	(Value, £.)		2,718		13,817

The wax yield in 1922-3 was 13 oz. per hive. Australia exports honey but imports beeswax, owing to the general use of frame hives.

H.H.

Beef-wood, a name applied to several quite unconnected Australian trees, resembling each other in the red colour of their timber. See CASUARINA and STENOCARPUS. For western beef-wood, see GREVILLEA.

Bees, insects of the group Anthophila and order Hymenoptera, which is well represented in Australia, no less than 872 species being recorded in the latest catalogue; of these the Prosopididae claim nearly 300, and the Colletidae, Andrenidae, and Megachilidae more than 100 each. The Colletidae are moderate-sized, short-tongued and very hairy. Our best-known genus is *Paracolletes*. The Prosopididae, also short-tongued, are smaller and smooth. Both these families contain mostly black or brown species, though some are strikingly marked—e.g. the wasp-like *Hyleoides concinna*, which has bright red marks on the face and abdomen. *Prosopis* is often to be found in swarms round flowering shrubs in the bush.

All the other families are long-tongued. The Andrenidae are burrowing bees; the commonest genus in Australia is *Halictus*. *Nomia australica* and *Parasphecodes leptospermi* are well-known visitants to the flowers of the tea-tree.

The Megachilidae (leaf-cutting bees) are represented by numerous species of the great genus *Megachile*, noted for their habit of cutting out of leaves circular pieces to be used for lining their nests. *M. mystacea* is shown on plate xix, fig. 41.

The large, stout carpenter bees (Xylocopidae)

bore holes in the stems of plants; the best-known of them are the bright metallic-green species of the genus *Lestis*, and the very large and handsome *Mesotrichia bryorum*.

The Anthophoridae are banded brown or fulvous; fewer than 20 species of this family are known in Australia. The handsome *Anthophora bombiformis* is shown on plate xix, fig. 42. Of the other families, the Melectidae are represented by the handsome genus *Crocisa*; the Ceratinidae by the well-known *Allodape* and *Exoneura*; and the true honey-bees (Apidae) by a few species of *Apis* and *Trigona*. The honey-bee of Europe (*Apis mellifica*) has become firmly established in a wild state throughout most parts of the Commonwealth. Of the true native bee (*Trigona*) nine species are at present known; they are small, mostly black in colour, and not endowed with stings. They may be found in all parts of Australia, in communities often numbering many thousands, occupying cavities in the trunks or branches of dead trees. These cavities may be in a hollow trunk only a few feet from the ground, but more usually occur near the top of a tall eucalypt; entrance is obtained through a small hole or crevice, which the bees make still smaller, until only one bee can enter at a time. *Trigona* makes no comb, but stores its honey in an irregular mass of pod-shaped receptacles with a hollow centre; in this hollow is built up a pyramid of saucers, and in these the young are reared. The wax is chocolate in colour. Several quarts of honey may be obtained from a single nest, but only at the cost of destroying a number of bees out of all proportion to the yield. The aborigines prized the honey greatly and invented many ingenious ways of procuring it. See HYMENOPTERA and BEE FARMING. R.J.T.

Beetles, vernacular name of a very large order (Coleoptera) of insects, whose distinguishing character is that (except in a very few cases) the fore-wings (elytra) are horny and used as protective coverings for the hind-wings. In a few families the elytra are soft; in others the hind-wings are absent, or so much reduced as to be useless for flight, the wing-cases being then united along the middle to form a single casing. These flightless groups occur in many families—e.g. the Broscinae among the Carabidae, many Helaeinae among the Tenebrionidae, the Amycterinae among the weevils. In a few cases apterous species occur in a genus usually winged (e.g., *Telephorus, Natalis*), and still more rarely the male is winged and the female apterous. All beetles undergo complete metamorphosis from the egg through larva and pupa to the imago. Most are vegetarians throughout life, though a few completely change their food when they attain maturity; some species are carnivorous.

The life-histories of Australian beetles have —with very few exceptions—been little studied, and should provide much important work for students. The correlation of our genera with the world-system also requires the attention of entomologists. Many of our beetles show a marked divergence from those of other countries; whole groups, and many genera, occur nowhere else. This is especially true of those from the central and western areas, and of apterous forms like the larger fossorial Carabidae, the hard-shelled ground-weevils, and the many striking Helaeinae.

The northern and eastern coast-regions have a considerable admixture of genera (and even of species) found also in Papua and Malaysia; a few extend to Fiji, New Zealand, and other Pacific islands. *Tricondyla aptera, Setenis sulcigera, Glenea picta, Sipalus gigas* are notable examples of species found on both sides of Torres Straits. The interesting Broscinae of the Carabidae find their nearest allies in South America, whereas the tiger-beetles of the genus *Megacephala* have close relations in both Africa and America. The cosmopolitan species, introduced through commerce—few in species but disastrously numerous in individuals—are notorious grain and store pests.

More than 15,000 species, belonging to about 2250 genera and 67 families, have been recorded from Australia. The following families—arranged on a plan modified from that of modern authors such as Ganglbauer, Handlirsch, and Lameere—contain the great majority of the species:—

Sub-order ADEPHAGA.

Families	Cicindelidae (tiger-beetles) Carabidae (ground-beetles) Dytiscidae (water-beetles) Gyrinidae (whirligig-beetles) Paussidae

Sub-order POLYPHAGA.

Group	Families
Palpicornia	Hydrophilidae (water-beetles)
Staphyliniformia	Staphylinidae (rove-beetles) Pselaphidae Silphidae (carrion-beetles) Histeridae
Malacodermata	Malacodermidae Cleridae
Clavicornia	Colydiidae Cucujidae Nitidulidae Erotylidae Coccinellidae (ladybirds) Byrrhidae (pill-beetles)
Sternoxia	Elateridae (click-beetles) Buprestidae (jewel-beetles)
Heteromera	Tenebrionidae Cistelidae Anthicidae Mordellidae Cantharidae (blister-beetles) Oedemeridae
Phytophaga	Chrysomelidae Cerambycidae (longicorns)
Rhynchophora	Curculionidae (weevils) Scolytidae Brenthidae Anthribidae
Lamellicornia	Lucanidae (stag-beetles) Scarabaeidae (chafers)

Twelve species are figured on plate ix, and thirteen on plate xi. References in this article are to plate xi.

The sub-order Adephaga—in which the first ventral segment is divided by the hind coxal cavities, and the hind-wing has one or two cross-veins near the middle—consists in general of carnivorous and predatory beetles, most with filiform antennae, and terrestrial, arboreal, or aquatic in habit. It includes the families Cicindelidae, Carabidae, Dytiscidae, Gyrinidae, and possibly Paussidae.

The Cicindelidae (tiger-beetles), with about 70 species, are active, predaceous insects found

more commonly in the tropical areas, but scarce in the south and absent from Tasmania. Species of *Distypsidera* run about tree-stems in the coastal districts of Queensland and northern New South Wales. The brilliantly-coloured *Megacephala*, found in the central and northern areas, are nocturnal in habit. *Cicindela* includes many of the smaller species. The silvery *C. ypsilon* may be seen on the sandy sea-beaches of eastern Australia. *Nickerlea Sloanei*, a western species, combines the habit and appearance of *Cicindela* with the mouth-parts of *Distypsidera*. The Carabidae (ground-beetles) are represented by some 1500 species contained in about 200 genera. Of the seven sub-families the Lebiinae—small, flat, brown beetles with red or black markings—are extraordinarily abundant under the loose bark of trees. The genus *Carenum* (of the Scaritinae), of burrowing habits and often of brilliant lustre, is peculiar to Australia. The genera *Silphomorpha* and *Adelotopus* (of the Pseudomorphinae), also found under bark, are remarkable for their oval form, short legs, and active habits. The Feroninae comprise large species very abundant in eastern Australia, *Homalosoma* and *Catadromus* containing especially fine examples. The Helluoninae are unusually numerous in Australia, the genera *Gigadema* and *Helluarchus* containing very large species; those of *Aenigma* are brilliantly metallic. The Cnemacanthinae are very numerous, and the genus *Promecoderus* is widely distributed; the extremes of size are to be noted in the extraordinarily elongate *Hyperion Schroetteri* (in which the hind-legs are placed unusually far back) and the minute blind species of *Illaphanus* —the former living in rotten pipes of the larger eucalypts of eastern Australia, the latter to be found by a keen eye under deeply embedded stones in New South Wales and Tasmania. The Pamborinae (eastern) and Cuncipectinae (western) are the only sub-families confined to Australia. The bombardier beetle *Pheropsophus verticalis*, black with red spots, is a noteworthy and widespread member of the Carabidae.

The Dytiscidae (170 species) are flat, oval, smooth water-beetles of voracious habits, with legs adapted for swimming, and elytra enclosing air for sub-aqueous breathing; they are mostly dark in colour, with paler spots or stripes. *Sternopriscus* is a distinctive genus, its many minute species having curious antennae and legs. *Eretes australis* occurs in countless numbers in most waterholes and creeks 'out back,' and forms an important part of the diet of aquatic birds.

The Gyrinidae (whirligig-beetles) are often seen darting about in companies on the surface of fresh water. They have short antennae and long front-legs, especially in the male the other legs being flattened into paddles. All have four eyes, enabling them to detect enemies (or food) in water or air. About 30 species are recorded, all of genera which range beyond Australia.

The Paussidae are a curious family of doubtful position, but with ventral segments as in other Adephaga. The species, some 50 in number (mostly of the genus *Arthropterus*), have wide, flat legs, widely laminate antennae, and membranous elytra-tips. These beetles are able to bombard; they are attracted to light; some live in ants' nests, but *A. brevis* occurs, sometimes in colonies, under eucalypt bark, or in crevices of decaying logs in New South Wales. *Megalopaussus amplipennis* is the largest of our species. Besides Australia this family is found chiefly in Africa and Asia; a few are known in Europe, and one species occurs in Brazil.

The sub-order Polyphaga includes the remaining groups, distinguished from the Adephaga because the first ventral segment is not divided by the hind coxal cavities, and the wings are not cross-veined near the middle. There are nine chief groups, comprising 29 families.

The group Palpicornia includes convex water-beetles of the family Hydrophilidae, with 6-9 jointed antennae and curiously modified palpi, often of great length, and five tarsi on each leg. More than 100 species have been recorded, of varied size, but generally of dark colour. As with the Gyrinidae they often take flight, and are attracted to strong light; *Pseudohydrobius floricola* is found on flowers.

The group Staphyliniformia—with short elytra that expose much of the abdomen—includes four families. The Staphylinidae (rove-beetles) contain nearly 600 Australian species of 100 genera. They have a mobile abdomen with apical appendages, and are found in decaying animal or vegetable matter, whereas *Dabra* and others occur in ants' nests and the Omalinae on flowers. *Conosoma* occurs under bark or with ants, *Creophilus* and *Philonthus* are scavengers, *Cafius* haunts decaying seaweed, and *Sartallus* fish-refuse. *Metoponcus*, with its pleasant scent, lives under the bark of native figs and sassafras; *Stenus coeruleus* occurs on foliage in the eastern brush forests. *Cryptommatus jansoni* is recorded as inhabiting the base of the tail of Tasmanian rats.

The Pselaphidae are small reddish beetles, with clubbed antennae, often found in nests of ants or termites, or in moss or vegetable debris. They feed on mites and other minute creatures, and often possess curiously-formed antennae and palpi, with marked sexual differences. The tarsi are 3-jointed. About 360 species are recorded from Australia. The sub-family Clavigerinae is represented by two genera, *Clavigeropsis* and *Articeros*; the former consists of two species, one Abyssinian, the other Australian. The many species of *Articeros* (now regarded as confined to Australia) have 2-jointed antennae, and tufts of hair on the abdomen which secrete a fluid that is greatly appreciated by ants. The Silphidae (carrion-beetles) comprise some 40 species; *Ptomaphila lachrymosa*, a large species, is found on carrion; the species of *Myrmicholeva* are inquilines in ants' nests. The Histeridae (over 100 species), generally flat, with a hard polished black surface, occur in decaying vegetable or animal matter. Species of *Hololepta* are found in rotting *Xanthorrhoea* stems from Perth to Sydney, often in company with *Platysoma* or *Acritus*; *Saprinus* occurs in carcases. An interesting race—*Chlamydopsis* and its allies—which has recently been investigated by A. M. Lea, inhabits ants' nests, having protective armour and retractile appendages.

The group Malacodermata includes two families of soft-skinned beetles with 5-jointed tarsi, abundant in summer on flowers and foliage. The Malacodermidae (400 Australian species) have long serrated antennae. The red or black species of *Metriorrhynchus* occur in profusion, some having a long rostrum like that of weevils. They are distasteful to birds, and hence appear to be closely mimicked by corresponding species and varieties of *Pseudolychus* (of the Oedemeridae). The genera *Carphurus*, *Balanophorus*, and *Laius*, numerous in species, possess extrusible vesicles. The small fire-flies *Luciola* and *Aty-*

phella—the apical segments of whose abdomina are phosphorescent—are mostly found in the warmer areas of the eastern coast. *A. lychnus* is to be seen among tree-ferns on the Blue Mountains. The Cleridae comprise 300 species of small and graceful flower-frequenting beetles, often of beautiful colour; most belong to the genera *Lemidia, Phlogistus,* and *Elecale.* Of predacious habits, their larvae are active. *Cylidrus* species feed on scolytid larvae and other bark-borers; *Stigmatium, Omadius,* and *Natalis* live under bark. The last-mentioned genus contains the giants of the family, *N. titana* measuring up to two inches in length.

The group Clavicornia is heterogeneous; its members have clubbed antennae and, usually, 5-jointed tarsi, but in Coccinellidae they are 4-jointed. The group includes six families. The Colydiidae and Cucujidae (each with about 100 recorded Australian species) live mostly under bark. The former are, in general, black and cylindrical, the latter mostly red or brown and very flat. *Eutermicola sculpticollis* occurs only in the nests of termites, *Nepharis alata* in those of ants. *Hectarthrum brevifossum* (of the Cucujidae) is remarkable for its wide distribution and great variation in size. The Nitidulidae (about 100 species from Australia) are small, flat beetles, often with shortened elytra; many occur in over-ripe fruit, in fungi or decaying vegetation. One species of *Brachypeplus* occurs in *Xanthorrhoea,* another in *Macrozamia,* and a third—*B. auritus*—in the nests of the native bee. The Erotylidae are fungus beetles, of elongate form and hard surface, with variously ornamental patterns. *Episcaphula hercules,* from northern Queensland, is the largest. The Coccinellidae (ladybirds), many of whose genera are of world-wide distribution, are noted for their economic uses in keeping down scale-insects and aphides in gardens and orchards. Some 300 Australian species are known. This family was by earlier authors included under Trimera, being supposed to have only three tarsi on each foot. *Rhizobius, Scymnus,* and *Orcus* are very numerous in species. The Byrrhidae (pill-beetles), a small family of little spherical beetles, includes the beautiful metallic species of *Pedilophorus* found in Tasmanian moss (fig. 6).

The group Sternoxia is a numerous tribe of elongate, hard-skinned beetles with a specially-constructed prosternum; the most important families are the two following. The Elateridae (click-beetles) have the pro-sternal process so fitted into the mesosternum as to enable the insect to jump with a jerk. The larvae of some species are the garden pests known as wire-worms. Above 500 species are recorded, mostly of dark colour, as in *Lacon* and *Monocrepidius;* but the species of *Cardiophorus* and *Ophidius*—found on flowers or foliage—are often ornamented with patterns. The largest species occur in *Tetralobus* (with pectinated antennae) and *Haus* (with lichen-like markings). The Buprestidae (with 760 species of 44 genera) contain the gems of our insect world, their brilliant colour and horny covering making some species suitable for mounting as jewellery. The larvae (see WOOD-BORERS) tunnel stems or roots of trees, and may be recognized by their swollen thorax. The beautiful endemic genera *Stigmodera* (fig. 7), *Curis, Neocuris* and the tropical *Calodema* and *Metaxymorpha* are found on flowers—especially of the honey-bearing eucalypts and of *Leptospermum;* the Chalcophorinae, *Nascio* and *Cisseis* are chiefly found on foliage. *Astraeus* and *Germarica* are associated with casuarina trees; *Melobasis* usually with acacias; *Diadoxus* with pines; *Cyria* with banksias. The curious and active *Xyroscelis crocata* is found on *Macrozamia* cycads as far apart as Perth and Sydney. All are winged, and many have strong powers of flight.

The group Heteromera, members of which have four tarsal joints on the hind and five on the anterior and middle feet, includes six families. The Tenebrionidae are a large and multiform family of nearly 1000 Australian species contained in 150 genera. Winged or apterous, they are chiefly nocturnal, and found by day in or under rotting timber, leaves, or under bark. In size they vary from the bead-like *Trachyscelis* of the sandy beaches to the large and brilliant Cyphaleinae. The Boletophaginae (*Mychestes* and its allies) are fungus-eaters; *Byrsax macleayi* is remarkable for its strong, musky smell. Peculiar endemic groups are the Helaeinae and Nyctozoilinae (mostly apterous), which are widely spread over the whole continent, and are especially characteristic of the dry inland regions. In *Helacus* the head is completely surrounded by the curiously wide-flanged pro-thorax. The 80 winged species of *Pterohelaeus* are bark-dwellers. *Adelium* and its allies are ground-beetles, numerous and widespread, *Cardiothorax* being confined to the eastern States. The Torresian fauna is largely represented by the Cyphaleinae and Amarygminae, generally of metallic form, ranging from Australia to India. *Menephilus, Meneristes,* and *Hypaulax*—all found in decaying timber—are typical Tenebrioninae. The Cistelidae are a rather fragile family of 140 species, separated from the preceding by the pectinate claws and lamellate tarsi. The metallic *Aethyssius* and the duller *Chromomoca* and *Homotrysis,* with their allies, include the majority of the species. The Anthicidae are ant-like and very active beetles, of which about 120 species are recorded from Australia, largely of the genera *Anthicus* and *Formicomus. Lemodes* (fig. 9), velvety red, sometimes with blue markings—which was formerly classed under Pyrochroidae—and *Trichananca* are confined to Australia. *Mecynotarsus* (often found on sea-beaches) has a curious crest projecting over the head. The Mordellidae (100 species) are active, triangular beetles, mostly of small size, that frequent flowers and are remarkable as jumpers. The allied Rhipiphoridae contain fewer species of larger size, the males of which have fan-like antennae. The Cantharidae (blister-beetles) comprise 80 Australian species, mostly of the beautiful genus *Zonitis.* The rare *Goetymes* and *Sitarida* have curiously abbreviated elytra. The Oedemeridae (about 60 species) have elongate bodies, with soft integument, often closely resembling the malacoderms. *Pseudolychus, Copidita,* and *Oxacis* are numerous in species and wide in range. The male of *Dohrnia miranda* has singular antennae, and the red-and-blue *Agasma semicrudum* is the giant of the family.

The group Phytophaga is by its name strictly a leaf-feeding group, and should therefore contain the Chrysomelidae only; but it is usually considered as including the Cerambycidae also, their tarsi (apparently four on each foot, but really five, since the fourth is a mere nodule) resembling those of the former family. The Cerambycidae (longicorns) are elongate beetles with unusually long antennae, notorious as timber-borers (see WOOD-BORERS) and often possessing strong powers of flight. Some 800 species, contained in more than 200 genera and three sub-families, have been recorded from Australia. Of these the Prioninae

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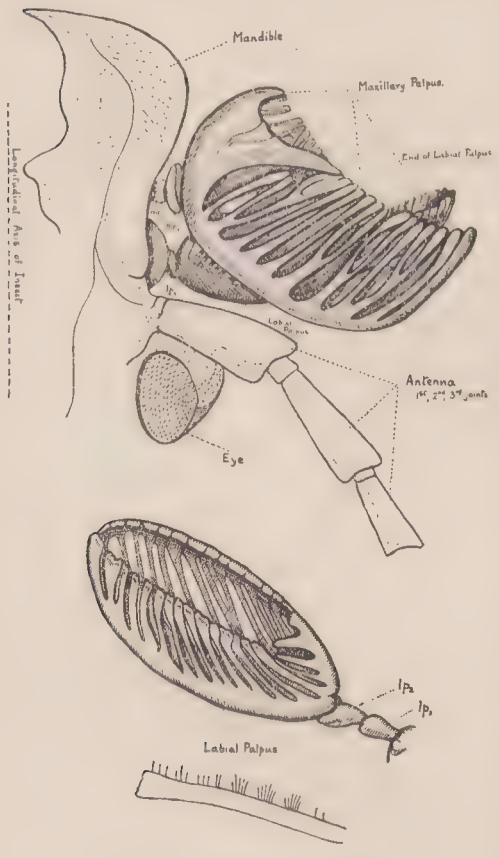
The group Phytophaga is by its name strictly a leaf-feeding group, and should therefore contain the Chrysomelidae only; but it is usually considered as including the Cerambycidae also, their tarsi (apparently four on each foot, but really five, since the fourth is a mere nodule) resembling those of the former family. The Cerambycidae (longicorns) are elongate beetles with unusually long antennae, notorious as timber-borers (see WOOD-BORERS) and often possessing strong powers of flight. Some 800 species, contained in more than 200 genera and three sub-families, have been recorded from Australia. Of these the Prioninae

are large brown beetles, whose larvae form a favourite diet of the aborigines. *Tillyardia mirabilis*, the most wonderful of the group, has palpi of unique (basket-like) form. The Cerambycinae contain smaller species of varied form and beautiful markings and colour. *Pseudocephalus* is ant-like; *Hesthesis* mimics the wasps. *Distichocera* shows great sexual differences; *Pterostenus, Syllitus,* and others give out a scent like carbolic oil, and are consequently distasteful to birds. The Lamiinae include the finest of the longicorns, many of which are true members of the Torresian fauna—e.g. *Glenea, Batocera,*



Palpi of *Tillyardia mirabilis*.

Monohammus, Olenecamptus, Gnoma; these are also found throughout Malaysia to India. *Microtragus* and *Athemistus* are apterous, found on or under logs or dead leaves. *Ancita, Zygocera, Symphyletes,* and *Rhytiphora* (fig. 12), are important genera with a wide distribution. The Chrysomelidae are an extensive family; nearly 1800 Australian species have been described. The Sagrinae are the giants of the family; in this sub-family half the Australian genera are endemic, *Megamerus* and *Polyoptilus* being richest in species. The Cryptocephalinae, of small size and beautiful colours, present strong sexual differences. *Ditropidus,* of globular form, is the largest genus. The Eumolpinae contain many pretty species of *Edusa* and its allies, as well as the two lovely species of *Spilopyra.* The Chrysomelinae include genera that range beyond Australia, and contain gems of the insect world like *Aesernia* (fig. 10), *Augomela, Phyllocharis* and their allies. *Paropsis* contains more species than any other Australian genus, some of which closely mimic Coccinellidae; others have in life exquisite colours, which fade rapidly after death, and thus become difficult to identify. The Halticinae (flea-beetles) contain genera mostly limited to Australia. The Hispinae are often closely set with spines. The Cassidinae are tortoise-like in form, fragile in structure and often of fugitive colours.

The group Rhynchophora has the head prolonged into a beak, with small, cutting mandibles at the apex; the tarsi are 4-jointed. Of this group by far the most important family—in number about one-fifth of the whole world of beetles—is that of the Curculionidae (weevils), of which more than 3000 species have been recorded from Australia, and many are notorious as vegetable pests and borers (see WOOD-BORERS). The Leptopsinae are apterous; many species of the typical genus *Leptops* attain great size, and are destructive to native and cultivated trees. *Catasarcus,* except for one species that ranges to Victoria, is confined to Western Australia. *Mandalotus* is a large genus of small species, often with remarkable sexual features. The Amycterinae—apterous ground-weevils with hard, rough cuticles—are confined to Australia, many of the smaller genera being limited to Western Australia. *Talaurinus,* and the allied *Sclerorrhinus* abound in the temperate and drier regions. The spiny *Acantholophus* and *Hyborrhynchus* are especially numerous in the west. The most striking genus is *Psalidura,* the males of which have a pair of powerful forceps protruding from a large apical excavation of the abdomen.

The Gonipterinae, almost confined to Australia, are peculiar in their covering of powdery meal. *Gonipterus* and *Oxyops* are abundant. In *Syarbis* the clawjoint is lost, the third joint being modified into a pad. Of the Hylobiinae, *Orthorrhinus* occurs in great numbers; *Eurhamphus fasciculatus* (found on pine-trees in Queensland and New South Wales) is the most striking species. The ornate Diamond-beetle (*Chrysolophus spectabilis*) belongs to this group. The Erirhininae include hundreds of small species; the clawless *Misophrice,* almost confined to casuarina trees, contains many species with brilliant scales. The Belinae are narrow, winged species limited to Australia, except for a few found in Papua, New Zealand, and South America. Of the timber-boring Cryptorhynchinae nearly 1000 species have been described; some of the genera range to Papua and New Zealand. *Protopalus* contains the largest species, with unusually long beak and antennae: in *Glochinorrhinus* there are tusk-like processes on the rostrum of the male. *Embaphiodes pyxidatus, Aethreus cicatricosus,* and *Hybomorphus mc'anosomus* are curious forms found on Lord Howe Island. Of the few Calandrinae, *Trigonotarsus* (confined to Australia) has but one species, *T. rugosus,* found in *Xanthorrhoea* stems. The Cossoninae are very numerous in Lord Howe and Norfolk Islands, which together produce more species than the whole mainland; (their chief Australian habitat is Queensland). Two blind species of *Halorhynchus* are found in Western and South Australia, and the Tasmanian *Tasmanica myrmecophila* is also blind. Of the allied families, the Scolytidae, with short rostrum, are few in number, but destructive to timber. The Brenthidae, of narrow elongate form and straight rostrum continuing the axis of the body, are few, and belong mostly to wide-ranging genera. *Cordus hospes* occurs in nests of

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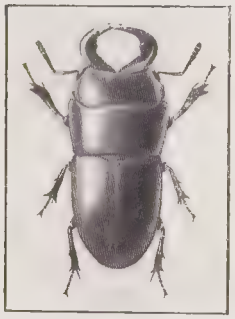

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1. *Agasma semicrudum*
2. *Arthropterus piceus*
3. *Hololepta australis*
4. *Heterarthrum brevifossum*
5. *Distypsidera undulata*
6. *Bolboceras sloanei*
7. *Lissapterus* sp
8. *Zopherosis georgei*
9. *Hyperion schroeteri*
10. *Tetralobus corrosus*
11. *Xylotrupes australicus*
12. *Phalidura miracula*

Average about one-fourth larger than natural size.

ants and termites in all the States. The Anthribidae, often with long antennae, number about 50 species on the mainland, but are numerous on Lord Howe and Norfolk Islands.

The very large group Lamellicornia—in whose members the terminal joints of the antennae form leaf- or comb-like plates, the feet have five tarsi, and there are in the males horn-like processes on head or pronotum—includes two families. The Lucanidae (stag-beetles) are remarkable for the enlarged mandibles of the males. They breed in decaying wood, and number 90 species in Australia. *Rhyssonotus* and *Lamprima* are peculiar to Australia, the latter containing fine species of brilliant metallic colours. *Phalacrognathus muelleri* (fig. 1), from northern Queensland, is one of the handsomest beetles in the world. *Eucarteria floralis* is a singular little species, found on flowers in the Dorrigo district of New South Wales. *Ceratognathus* and *Lissotes* are strongly represented in Tasmania, and extend to New Zealand. The Passalinae consist of large, black, parallel-sided species that abound in decaying logs in forest country; the external sexual features are little in evidence. Their species mostly belong to two genera, *Pharochilus* and *Aulacocyclus;* they stridulate loudly, and form a connecting link with the Scarabaeidae (chafers). These are more abundantly represented in Australia than in any other continent, by nearly 1600 species, contained in 160 genera and 8 subfamilies. The Coprinae and Aphodiinae are mostly dung-eaters, and through the paucity of large native animals are but scantily represented. The species of *Cephalodesmius* form balls of earth in which they place their larvae. The Geotrupinae, chiefly of the genus *Bolboceras*, bore two feet or more into the soil, stridulate loudly, and are readily attracted to light. The Troginae occur mostly in dried carrion. The Melolonthinae, comprising more than half the family, occur on flowers and foliage. *Heteronyx* alone contains 400 species of dingy colours; *Haplonycha, Pachytricha,* and *Lepidiota* include the bulkier forms. The metallic species of *Diphucephala* sometimes cause foliage to seem bespangled with gems. The Rutelinae also occur in masses, denuding eucalypts of their leaves; among them *Anoplognathus* and its allies are prominent, *A. viridiaeneus* being the well-known 'King'-beetle of the Sydney district. The Dynastinae are mostly solid, polished black species, whose males have conspicuous horns. *Haploscapanes barbarossa* is the largest of Australian beetles; *Cryptodus, Cavonus,* and *Pseudoryctes* all contain interesting forms. The Cetoninae are especially valued by collectors for their beauty of pattern: they have strong powers of flight, and are usually taken on flowers. *Diaphonia* and *Chlorobapta* are widely distributed. *Lomaptera* and *Trichaulax* (fig. 2), are typical of the fine tropical genera. A single species of *Microvalgus* is the only Tasmanian representative of the sub-family.

For the systematic literature up to 1887 see Masters's *Catalogue of the Australian Coleoptera,* published by the Linnean Society of New South Wales. Amongst Australian entomologists the pioneer work of W. S. Macleay (see MACLEAY, ALEXANDER) has been followed up by Blackburn, Carter, Ferguson, Lea, Olliff, and Sloane, whose work may be found in the publications of various Australian learned societies. See also Tillyard's *Insects of Australia and New Zealand.* H.J.C.

ECONOMIC IMPORTANCE. Many beetle families —notably the chafers, scarabs, weevils, borers, and longicorns—are pests of great economic importance. The Sugar-cane Beetle (*Lepidiota albohirtum*), a large chafer densely clothed with white scales, infests the Queensland canefields, its larvae attacking the roots of the canes in large numbers. Tons of beetles and grubs are destroyed yearly, but these probably include many harmless species. The beetle's life-history is known, but root-pests are difficult to combat, and no satisfactory remedy has yet been found. *L. frenchi* also attacks sugar-cane, but to a slighter extent.

A small bright-green scarab (*Diphucephala colaspidoides*) is a serious pest to stone and pip fruits, and to raspberries, in Victoria and Tasmania. It occurs in numbers sufficient to bend and completely to defoliate branches, and is especially prevalent where wattle-trees have been numerous. When an apple-tree is attacked, every leaf is sometimes riddled, though only one out of a bunch of apples may be infested; on that apple, however, so many beetles will be crowded that room can be found only for their heads and front-legs. The larvae destroy grass-roots. A small brown chafer (*Scitala pruinosa*) similarly defoliates pear, cherry, and plum trees. When flying round a tree at night, its numbers produce a sound like that of swarming bees. Several species of *Heteronyx* similarly injure fruit and other trees at night.

The large, brilliantly metallic chafers (*Anoplognathus* and its allies) commonly known as king-beetles attack the foliage of eucalypts, pepper, and other trees; their larvae as a rule feed on rotting wood or grass-roots and, in some species, on strawberry plants. In Western Australia the allied *Anoplostethus opalinus* injures pear trees; in Queensland *Calloödes grayanus* attacks sugar-cane.

Among the weevils *Leptops squalidus* in Victoria and New South Wales, *L. robustus* and *L. rhizophagus* in South Australia, unsatisfied by their natural hosts the wattles, have become serious menaces to apple trees, and sometimes to grape-vines; the larvae gouge out channels along the main roots, and open the way for fungous growth. *Orthorrhinus cylindrirostris* attacks citrus, stone, and pip fruit with indiscriminate appetite, the beetles nibbling the buds and bark, the larvae boring the stems. They are especially prevalent near newly-cleared land or ring-barked country, and a newly-felled eucalypt may at night swarm with them. Two smaller species, *O. klugi* and *O. aethiops,* are destructive, the former to the rose in particular.

Strawberries are so injured by two species of weevils—*Rhadinosomus lacordairei* and *Rhinaria perdix*—that many Tasmanian growers have ceased to cultivate this fruit on a commercial scale. In South Australia *Neomerimnetes destructor* has been found to riddle the foliage. *Desiantha maculata, D. nociva,* and *Perperus malevolens* may be termed 'bud-weevils,' the first attacking the buds of fruit-trees and grape-vines by night, the second specializing in tomatoes and other vegetables, the third preferring apricots and other fruit-trees. In New South Wales and Queensland a tiny weevil known as 'Dicky Rice' (*Maleuterpes phytolymus*) attacks the leaves of citrus trees, so that they appear as if threshed by hail.

Shot-hole borers (Scolytidae) and auger beetles (Bostrychidae) attack trees and newly sawn timber. Of the latter family *Bostrychopsis jesuita* riddles orange trees over a wide range, *Xylion collaris* has been found attacking stored wheat, and *X. cylindricus* occurs in mills as well as in timber; *Xylothrips gibbicollis* has been recorded as boring into lead—as also have certain species of white ants. Introduced beetles be-

longing to the same tribe (Bostrychoidea), close relatives also of the European 'death-watch,' are described under WOOD-BORERS, as are the shot-hole borers which affect unseasoned wood.

Three introduced weevils of interest to horticulturists are *Neosyagrius cordipennis*, which breeds in maiden-hair fern, *Syagrius fulvitarsis*, which infests the frond-stems of larger ferns, and *Acythopeus aterrimus*, found in the pseudobulbs of orchids.

In eastern Australia citrus fruits may be attacked by a fine longicorn beetle, *Uracanthus cryptophagus*, whose larva drills a branch and constructs a special chamber above which it pupates. With the first heavy wind the branch snaps at this chamber. The allied species *U. maleficus* similarly destroys filberts in Tasmania. Many other longicorns attack eucalypts and wattles: thus the well-known 'firewood beetles' (*Phoracantha* and its allies) may be seen in quantities at night on felled timber; and they have lately been introduced into South Africa, where they are a serious pest on wattle plantations.

The Pumpkin Beetle (*Aulacophora hilaris*) attacks all the cucumber family, and is widely distributed in Australia, sometimes rendering pumpkin-growing almost impossible. Another leaf-eater in eastern Australia is *Monolepta rosea*, and *M. divisa* attacks grape-vines.

Among introduced grain-beetles the Wheat Weevil (*Calandra oryzae*) gained notoriety by his devastating attacks on immense stacks awaiting export during the war; over 8 millions of bushels were lost through this pest and *Rhizopertha dominica*. The former attacks maize, and may often be seen in the ripening cobs. Other mischievous pests in flour or grain are *Calandra granaria*, *Tribolium ferrugineum*, the horned *Gnathocerus*, *Tenebrio molitor*, and *T. obscurus*, *Anobium paniceum* (Biscuit Beetle) and the saw-toothed *Silvanus surinamensis*. The smaller kinds may often be seen baked in bread. It is now known that grain-weevils can develop only where the environment is sufficiently moist; protection can thus be secured by giving wheat perfectly dry storage, as in properly constructed elevators. (See WHEAT.)

Three European weevils of the large genus *Otiorhynchus* have become established in Australia. Of these the small brown *O. cribricollis* does an immense amount of damage to fruit-trees and other cultivated plants, including the rose, and in some districts is more injurious to apple trees than all other pests combined; leaves, bark and fruit are all attacked, and the roots are injured by the larvae. The larger *O. sulcatus* is troublesome in Victoria and Tasmania, but the third, *O. scabrosus*, has not yet become a serious danger.

In Queensland and New South Wales the Sweet-potato Weevil (*Cylas formicarius*) has been introduced.

The Cigar Beetle (*Lasioderma serricorne*) attacks tobacco, stored meals and other dried products; strychnine beans in a chemist's shop in Adelaide were reduced to powder by these beetles, which also injure dried plants and certain kinds of leather.

The skin-eating *Dermestes* are cosmopolitan and ubiquitous. *D. vulpinus* and *D. cadaverinus* are to be seen on carrion throughout the country, and green hides are painted with arsenical preparations as a protection against them. *D. lardarius* is a bacon pest, found in most stores, and the allied species of *Anthrenus* are notoriously destructive to natural history specimens in museums.

A.M.L.

Bell, SIR JOSHUA PETER (1827-1881), born in county Kildare, Ireland, on 19 January 1827, was brought by his parents to Sydney in 1831 and educated at Sydney College and the King's School. In 1847 the family acquired from Richard Scougall Jimbour station, one of the biggest and best estates on the Darling Downs, and Joshua soon became known as a grower of prize wool. Elected to the Queensland legislature in 1863, he joined the Herbert ministry as treasurer in 1864 and retained the post under Macalister. During 1866, being faced with the failure of two banks and a consequent financial crisis, he proposed to issue inconvertible 'legal tender' notes to the amount of £200,000, but Sir George Bowen, then governor, refused to countenance such a policy, and the ministry resigned. Bell retained his seat in the assembly until 1879, holding office under Macalister (1866-7) as secretary for lands and under Palmer (1871-4) as treasurer. In 1879 he was transferred to the legislative council and made president of that body—in which capacity he administered the government from March to November 1880 during the absence of the governor. He died on 20 December 1881. (K.C.M.G., 1881.)

—His son JOSHUA THOMAS BELL (1863-1911), born on 1 March 1863 and educated at Ipswich and Brisbane grammar schools and Trinity Hall, Cambridge, was called to the bar at the Inner Temple in 1888, and in 1890 became private secretary to Samuel Griffith. In 1893 he entered the assembly as member for Dalby (the constituency in which Jimbour lay), and after an active career as a private member—during part of which he was chairman of committees—joined Arthur Morgan as secretary for lands (1903-6), retained that office in the first Kidston ministry (1906-7), and resumed it for eight months in the second Kidston ministry, but was then ousted by D. F. Denham. For another eight months he remained in the ministry as home secretary, but on 29 June 1909 retired from active politics, a disappointed man, to the speaker's chair. In July 1910 ill-health forced him to hand over his duties to a deputy, and on 10 March 1911 he died. Bell was one of the ablest men in the parliaments of his day, but his polished manners and scholarly reputation cut him off from the mass of his fellow-members and detracted from his popularity. He was specially interested in land legislation. While still a private member he passed the first of a long series of acts designed to encourage the extirpation of the prickly pear pest. His land acts amendment act of 1905 was drafted 'with the object of putting as many people on the land in Queensland as official action can accomplish,' and might have accomplished a great deal but for the unsympathetic administration of his successors. Among many notable features it provided for the provisional selection and purchase of farms by intending settlers before they left England—the option being left to them of cancelling the purchase after a fair trial of the chosen farm—and for the settlement of groups of migrants (either from Britain or from other Australian States) on adjoining farms.

Bell-bird, Crested. See THICKHEADS.

Bell-bird, Green. See MINERS.

Bell-magpies. See MAGPIES.

Bell's Line. See EXPLORATION BY LAND and COX, WILLIAM.

Belmore, EARL OF (1835-1913). Somerset Richard Lowry-Corry, born in London on 9 April 1835, was the eldest son of the third earl of Belmore and succeeded his father in December 1845. He was educated at Eton and Cambridge (M.A., 1856). Elected a representative peer for Ireland in 1857, he was for the next ten years employed on committee work of the house of lords, and in 1866 became a junior member of the third Derby ministry. The next year he was appointed governor of New South Wales, and arrived in Sydney on 7 January 1868, in time to receive Prince Alfred (the Duke of Edinburgh), who as captain of H.M.S. *Galatea* was on a visit to the Australian colonies. On 12 March, while at a public gathering in Clontarf gardens, Middle Harbour, Prince Alfred was shot in the back by a Fenian, Farrell, but not seriously hurt. This, and the opening of the first intercolonial exhibition in Prince Alfred park during 1871, were the only important events of Lord Belmore's governorship. His health compelled him to resign his post on 22 February 1872; he returned to England, and spent the rest of his life in minor public duties and in managing his Irish estates. As his wife was a niece of W. E. Gladstone and his cousin (Montagu Corry, afterwards Lord Rowton) private secretary to Lord Beaconsfield, he was a *persona grata* in both political camps. He served on two educational commissions and on the judicial committee of the Irish privy council. He died on 6 April 1913. (K.C.M.G., 1872; G.C.M.G., 1890.)

Benedictine Order, THE, IN AUSTRALIA. While the foundations of the Catholic Church in Australia were surely laid by a secular priest—Father Joseph Therry, q.v.—the credit of building it on those foundations for its first half-century belongs to a succession of Benedictine fathers and bishops. Even before Father Therry's arrival the settlements in Australia had been placed under the jurisdiction of a Benedictine, Bishop Slater of the Mauritius, who was succeeded in that see by another Benedictine, Bishop Morris. The first priest of the Order who actually worked in Australia was Father Ullathorne; he was soon followed by Dr. Polding, first bishop and archbishop of Sydney, who brought with him or in his train a long series of Benedictines, most of them from the monastery of Downside in Somerset. The most notable among these, after Drs. Polding and Ullathorne, are perhaps Archbishop Vaughan of Sydney, Bishop Davis of Maitland, Abbot Gregory of the monastery founded at Sydney, and (from the Spanish Benedictines) Abbot Salvado of New Norcia in Western Australia, whose work is still under Benedictine control. A short account of the New Norcia settlement is given under that name.

In 1847 Archbishop Polding brought out from English convents two Benedictine nuns to establish in New South Wales a convent and a girls' school. He settled them on an estate then known as 'The Vineyard' (now Subiaco) near Parramatta, which he bought from Hannibal Macarthur; the convent was opened on 2 February 1849 and the school on 25 March 1851. The school is now closed, and the convent has adopted the strict Benedictine 'enclosure.' In 1925 30 members of the community were securely maintaining the foundation. Details are given in H. N. Birt's *Benedictine Pioneers in Australia* (ii. 399-404), which should also be consulted on the whole subject. E.M.O'B.

Bennett, GEORGE (1804-1893), born at Plymouth in England on 31 January 1804, took to sea travel at an early age, and when only 15 visited Ceylon, returning in 1821 by way of the Mauritius. He then studied medicine (M.R.C.S., 1828; F.R.C.S., 1834; M.D., Glasgow, 1859), and as soon as he had obtained his first diploma joined the *Sophia*, which in November 1828 began a voyage of exploration in the Pacific. In this vessel, where he had charge of the scientific observations, he in 1829 visited Sydney. Returning to England in 1831, he left the next year in the *Brothers*, landed at Sydney on 25 August, and spent seven months in the western foothills of the main range from the Cudgegong southwards, devoting especial attention to the Tumut and upper Murrumbidgee districts; the results of his observations in Australia and during a very roundabout return to England he embodied in a book—*Wanderings of a Naturalist in New South Wales, Batavia, Pedir Coast, Singapore and China*—published in London in 1843. His most important observations, however, those on the platypus (which he was the first to describe with any detail), were entirely omitted from this book and published separately the same year as *Notes on the Natural History and Habits of the Ornithorhynchus Paradoxus*. During 1835 he was back in Sydney, where he settled down to practise his profession, but was never too engrossed in it to neglect the study of natural history. For 50 years he kept up a regular correspondence with Sir Richard Owen—whose first great scientific memoir 'On the Pearly Nautilus' was based on a specimen, the first ever preserved of the actual animal (as distinguished from its shell), which Bennett had obtained in the New Hebrides in 1829 and brought to England for him in the *Sophia*. In Sydney he took an active interest in the botanic gardens, the Zoological and Linnean Societies, and the Australian Museum, of which he was the first curator. His title in this office varied from time to time; prior to 1841 he was called director, superintendent, zoologist, curator or secretary in various equally official documents. In 1838-53 he was also a member of the museum committee, and in 1853-74 an elected trustee of the institution. Among his discoveries must be noted that of the New Britain cassowary (named in his honour *Casuarius Bennetti*). In 1877-9 he visited Europe, and received scientific honours in both England and Italy. He died at Sydney on 29 September 1893.

Besides the books already mentioned he was the author of *Gatherings of a Naturalist in Australasia* (1860), and of pamphlets or reports on influenza in sheep (1836), acclimatization (1862) and the cultivation of citrus fruits (1871). Among his many honours he received the gold medal of the Royal College of Surgeons, the silver medals of the Zoological Society of London and the Acclimatization Society of Victoria, and the Clarke memorial medal of the Royal Society of New South Wales.

Bennett, SAMUEL (1815-1878), born at Camborne in Cornwall on 20 March 1815, came to Australia in 1841 under engagement to the then proprietors of the *Sydney Herald* (now *Sydney Morning Herald*), Messrs. Stephens and Stokes, and when Messrs. Kemp and Fairfax took the newspaper over became head of the printing department, a position which he occupied for 17 years. In 1859 he bought the *Empire*, which

Henry Parkes had started in 1850, and ran it as a daily newspaper with a weekly edition until 1875. In 1867 he commenced publication of the *Evening News*, to which three years later he added a weekly paper, the *Town and Country Journal;* and in 1875 he amalgamated the *News* and the *Empire*. He contributed often to the literary columns of his papers, and in 1865 began to compile a *History of Australian Discovery and Colonization* which appeared in chapters in the weekly edition of the *Empire*. In 1867, however, when the narrative had reached the year 1831, he found business affairs too pressing to allow of further historical research, and accordingly published what had already been written as a book (five parts in one volume); this was for many years the best and most accurate account of early Australian history, and is still worth study. It may be noted that many copies have a double title-page, that dated 1865 being the original title-page of the first part, and that dated 1867 the title-page proper to the whole book.

Bennett died at Little Coogee, near Sydney, on 2 June 1878. Henry Kendall, with whom he had a warm friendship, enshrined his name with those of Stenhouse, Harpur, and William Ridley in 'By the Cliffs of the Sea.'

Bent, Andrew (1795-1850), is first heard of as an employee on the government printing press in Hobart soon after 1810. Fawkner's *Launceston Advertiser* on 3 August 1829 printed a statement in which Bent—described as 'the "errand boy" from the *Public Ledger* office in Warwick Square, London'—is said to have been taken on as assistant by George Clark (the printer of the first Tasmanian newspaper) 'in process of time'—that is, not actually at the beginning of the publication. However, since the same authority states that Bent 'came to the colony a mere boy, and has resided in it sixteen or seventeen years,' he could hardly have been in Clark's employ before 1812, by which time the newspaper had been discontinued. In 1814 a second attempt was made, the *Van Diemen's Land Gazette* appearing in nine issues between May and September with Clark as printer; soon afterwards Clark was dismissed by the government, and on 1 June 1816 Bent issued 'by Authority' the first number of the *Hobart Town Gazette*. At the same time he carried on business as general printer, in 1819 issued the first Tasmanian book (a biography of Michael Howe the bushranger), and in 1821 added copper-plate printing to his business. In 1825 he was involved in trouble with Governor Arthur, having published a series of letters signed 'Colonist' which attacked the administration with much acridity, and on 1 August was fined £500 and imprisoned. The *Gazette* passed into other hands, but Bent took the earliest opportunity of issuing the *Colonial Times*, which, he claimed, 'was established in 1816 under the title of the *Hobart Town Gazette.*' As might be expected, the *Times* devoted itself to attacks on the government; after about two years he handed it and its traditions on to Henry Melville, chiefly because Arthur had on 19 October 1827 prohibited the publication of unlicensed newspapers and simultaneously refused to grant Bent a licence. Bent tried to continue the *Times* as a sheet of advertisements, issuing also a monthly magazine, the *Colonial Advocate* (March-October 1828); Arthur had him condemned and imprisoned for the first publication, and released him only on a promise to drop the second. Since the licensing act was disapproved by the British government, Bent appears to have deserved compensation; but he got none. His printing office continued to do business, and from it in 1824 was published the first *Van Diemen's Land Almanack*, which Bent himself compiled. But he could not abandon journalism; in 1833 he was publishing Robertson's paper, *The True Colonist;* in 1835 he started another venture of his own, *Bent's News and Tasmanian Threepenny Register*, which ran till the middle of 1837; then, tired of the long struggle, he migrated to Sydney, taking his printing plant with him, and issued the first number of *Bent's News and New South Wales Advertiser*, which ran for two years and was then sold to the Roman Catholics to reappear as the *Australian Chronicle*. In 1843, by which time he had left Sydney and settled on the Macleay River, he was out of work and appealing for a position as printer, reader, or superintendent of some public journal, claiming to be 'the Father of the Press in these Colonies.' In 1845 he was forced into an appeal to 'the generous inhabitants of Van Diemen's Land,' and in 1850 died in straitened circumstances.

Bent, Ellis (1779-1815), son of R. Bent, was educated at Cambridge and called to the bar in 1805, practising on the northern circuit. Four years later he was sufficiently well-known to be described by Lord Castlereagh as 'a barrister of eminence.' In 1809 he was appointed—apparently on the recommendation of General Nightingall—judge-advocate of New South Wales, the commission being ante-dated to 1 January. He made the voyage out with Macquarie, who was at once attracted by him, consulted him on all important legal matters for several years, and named Bent-street in Sydney after him. Up to Bent's time no judge-advocate had been a legal expert, and his chief work after his arrival was to devise a new system of courts and procedure to supplant the rough and ready proceedings of the early naval governors; his report of 19 October 1811 was adopted in its entirety by the parliamentary committee of 1812 on transportation, but its most important recommendation—for the establishment of trial by jury—was set aside by Lord Bathurst, who determined to retain the existing system of criminal trials while establishing two new courts on the civil side. Macquarie promptly recommended Ellis Bent for the principal judgeship, and suggested his younger brother Jeffery Hart Bent as assistant judge. In the end, however, J. H. Bent was made sole judge.

The two brothers were of very different temperaments. Ellis was in 1811 described by Macquarie as 'blending the mildest and gentlest disposition with the most conciliating manners, great good sense, and accurate legal knowledge;' and all else we know of him confirms this judgment. Jeffery, on the other hand, was exceptionally hot-tempered and sensitive of slights, and often unrestrained in his language. It would not have been surprising if his arrival in the colony had led to friction between Macquarie and Ellis Bent. But in fact the friction had already occurred. In the spring of 1813, according to Macquarie, Bent grew impatient at the delay in building him a proper court-house, and an angry conversation resulted in the abandonment on both sides of all friendly intercourse; while the facts may be as Macquarie states, it is more probable that the personal element in the quarrel was due mainly to Macquarie's persistent policy of introducing emancipists at government house as the

social equals of the free settlers and officials, against which Ellis Bent protested in a letter written to Lord Bathurst in October 1814. Undoubtedly the existing friction was considerably embittered when Jeffery Bent arrived. The brothers were at one in determination not to admit to practice any ex-convict attorney, and Ellis, besides several minor grievances, was at odds with Macquarie about a matter curiously like that which nine years later caused a bitter dispute between Saxe Bannister (q.v.) and Brisbane. Macquarie drafted some port regulations and sent them to Ellis Bent (his official legal adviser) for revision and proper phrasing: Bent refused on the grounds (*a*) that it was not his business, (*b*) that he thought some of them *ultra vires*: both sides appealed to the authorities in London, and Bathurst decided that Macquarie was right, and that the Bents must be removed from office. It is important to note the ground of this decision. In their protests, said Bathurst, the Bents were right: convict attorneys should not be employed except in very rare circumstances, and Ellis Bent was justified in protesting against the port regulations if he thought them *ultra vires*. But neither he nor his brother had any right to embarrass the administration of the colony because of differences of opinion, and Macquarie's forbearance in not suspending them from office, and so holding up judicial proceedings in the colony, was specially and warmly approved.

Before, however, this recall could be put into force—before it was even decided on—Ellis Bent was dead. A long illness (which may have helped to make him unwontedly impatient in the last year of his life) ended on 10 November 1815, just after he had been given long leave to take a holiday in India and Europe. And Macquarie's despatch of 16 January 1816, recording the death, and witnessing to Bent's faithful, indefatigable, and able administration of justice during the whole of his public career, is good evidence of the writer's as well as of the subject's virtues.

Bent was buried in the George-street cemetery (where the town hall now stands); but his body was soon removed to Garden Island, where after a while he shared a grave with Major Ovens. Then both bodies were transferred to the graveyard of St. Thomas's, North Sydney, where they now rest under the Garden Island monument. Bent's first gravestone was simply turned over and used later for that of Anthony Fenn Kemp.

Bent, Jeffery Hart (1780-1852), brother of Ellis Bent mentioned above, was like him educated at Cambridge, and seems to have been called to the bar in 1806. In 1814 he was appointed by the colonial office first judge of the newly created supreme court, and reached Sydney on 28 July in that year. But the court never functioned under him. On various pretexts he delayed the first sitting until 1 June 1815, and then the first business concerned the admission to practice of certain local attorneys who had been sent out as convicts. They had since become free men either by expiration of sentence or by formal emancipation, and had been allowed to practise in the old court; but Bent announced that no persons who had been transported to Australia would ever be allowed to practise before him, and persuaded his brother to make a similar rule for the 'governor's court' over which he presided. It so happened that the first two applicants for admission had been originally convicted, the one of perjury, the other of forgery, so that there was obviously a prima facie case against their admission as officers of a court of justice; and the two magistrates who sat on the bench with Bent, while disagreeing with his general rule, explicitly reserved the right to refuse their applications. But Bent's hasty and domineering disqualification of all emancipists, his behaviour in court and outside to the magistrates and others who questioned his decision, and his suspension of all the functions of the court until a final decision could be received from London, roused against him not only public feeling in the colony and the wrath of Macquarie but also the severe displeasure of Earl Bathurst. 'Whether convicts be or be not authorized to practise' wrote Bathurst, 'is a question of little importance when compared with the consequences arising out of its agitation, the closing of the supreme court of the colony for at least twelve months.' Bent was accordingly recalled. By this time, however, he seems to have lost his head altogether, for he had committed to gaol one of his own colleagues who was employing Mrs. Bent's ex-cook, had repeatedly forced his way through toll-gates without paying toll, and even after his formal suspension by Bathurst claimed that he must retain his position until the arrival of his successor. Consequently Macquarie on 11 December 1816 announced in general orders that Bent was 'positively and absolutely removed' from the judgeship, and early in 1817 he returned to England by way of India. For two years thereafter he persistently bombarded the government with demands for reparation in one form or another—he even suggested that he should be appointed 'Civil Governor of New South Wales.' In 1820 he was made chief justice of Grenada, passing on to a similar position in St. Lucia, thence to the bench of Trinidad and finally to the chief justiceship of British Guiana. He died in office on 29 June 1852.

Jeffery Bent was first and foremost gifted with immense self-conceit. At the back of every complaint he made and every trouble he stirred up we detect irritation at something which he took for a personal insult. 'My Office as Judge of the Supreme Court and as a Barrister of near 10 years standing' was in his eyes the central fact of the situation in all correspondence with Macquarie and with his colleagues. In a convict colony under military rule, with its free institutions still in a state of flux, this insistence on details of etiquette and claim to authority independent of the governor's was not only embarrassing but dangerous, and Bathurst could do no less than remove him: but the same temperament might be (and apparently was) harmless and even useful in older colonies, where the minutiae of procedure regarding interdependence, relative rank, etc., had long since been laid down and stereotyped.

Bent, Sir Thomas (1838-1909), born on Sir John Jamison's estate near Penrith in New South Wales on 7 December 1838, and brought while a child by his parents to live on a market-garden in the closely cultivated area south-east of Melbourne, in 1859 started a garden of his own and began to interest himself in municipal life; in 1861 he was made rate-collector for Brighton, and the next year entered the Moorabbin shire council. Thoroughly representative of the community he lived in, and gaining much popularity among his neighbours, he surprised Victoria in 1871 by defeating George Higinbotham, the ablest man then in public life, for the Brighton electorate; Higinbotham knew little about the

local needs of his constituents and fought the election on big issues, whilst Bent spoke as a market-gardener to others of his trade. Moreover, Higinbotham's sturdy Australianism and his opposition to the interference of the colonial office in local affairs arrayed against him most of the wealthy voters of what was then an aristocratic community. Bent, on the other hand, was already a trusted organizer in the conservative party, and a man of capacity, courage and self-reliance. Entirely self-educated and a keen student of his fellows, he soon became 'an old parliamentary hand,' attached himself to the party led by Service (q.v.), was made party whip, and was mainly responsible for Berry's defeat in 1880. In the short-lived Service ministry of that year he held a small unsalaried position, but in the O'Loghlen ministry of 1881-3 was minister of railways, and was so lavish in his expenditure and his proposals for new non-paying, vote-catching lines that his administration was Service's chief argument a year or two later for the handing over of the railways to a non-political commission. These lines, it may be added, are among the best railway assets of the present time. Towards the end of 1883 he was acting-leader of the opposition, but was found too brusque for the work. In 1887 he was made chairman of the parliamentary standing committee on railway construction, and surpassed his previous record of expenditure, but in May 1892, in anticipation of a regime of railway economy, was transferred to the speakership of the house of assembly. While occupying this post, he never troubled to become a master of parliamentary practice, substituting a ready mother-wit for this knowledge. On one occasion, in a sudden turmoil, he gave a ruling that was obviously against all precedents, and when challenged said nonchalantly 'Well, that's my ruling for to-night anyway.'

Having from 1887 onwards taken an active (but not a dishonourable) part in the land 'boom' which ended disastrously in 1893, Bent was left almost penniless, was rejected by the Brighton electors and spent the next six years farming near Port Fairy. It was from the experience of these years that he learnt, as he afterwards said, 'to take off my hat to a cow.' In 1900 he re-entered State politics, was once more elected for Brighton, engineered his way to the front, and in June 1902 joined W. H. Irvine's ministry as commissioner of public works and minister of railways. Irvine being rather a philosopher than a politician, Bent was the mainstay of this ministry, and the defeat of the great railway strike of 1903 was mainly his work. In February 1904 Irvine, weary of dealing with men whose thoughts and motives he could not understand, resigned office and left the premiership to Bent; this he held until December 1908, when he was defeated in parliament. He died worn out on 17 September 1909.

Thomas Bent was a sturdy political fighter, of great natural capacity and shrewdness, and a keen student of finance. He was quick to discern incapacity or mediocrity in his subordinates, and attached to himself, particularly in the treasury, men on whom he could rely. He understood, too, the necessity of increased assistance to university and secondary education, and on the report of a royal commission doubled the endowment of the university of Melbourne, and made available a large sum to cover all its outstanding needs. His career is at once an advertisement for and a warning against ultra-democracy. He won and retained many unsuitable positions simply by being just on a level with the men who chose him; if he had little expert knowledge and low standards, so had they; they liked his 'masterfulness,' and said approvingly that he 'had no nonsense about him.' It is much to his credit that on certain matters, such as education, he admitted his ignorance and sought the advice of the best men procurable. Further, while using any convenient means to gain his ends, he never shirked the responsibility for having used them —an unusual virtue among politicians. (K.C.M.G., 1908.)

Berry, ALEXANDER (1781-1873), born at Cupar in Scotland on 30 November 1781, was educated at the Cupar grammar school (where he had for a fellow-student John Campbell the great lord chancellor) and at the universities of St. Andrews and Edinburgh. At the latter he qualified as a surgeon, and almost immediately joined the service of the East India Company as surgeon's mate, rising after one trip to China to the position of surgeon in the *Hawkesbury*, and combining his professional duties with a certain amount of trading. A few years later he shipped as supercargo in a vessel trading to the Cape of Good Hope, and while there heard that great floods had caused a famine in New South Wales. At once he bought a 526-ton prize ship lying in Table Bay, named her the *City of Edinburgh*, took aboard a cargo of provisions, and sailed for Australia on 4 September 1807. Persistently stormy weather forced him to put into Port Dalrymple in Tasmania, where his cargo was very welcome; half he sold there, and took the rest to Hobart, where also provisions were much needed. When on 12 January 1808 he reached Sydney, he found himself in hot water with Bligh for not bringing the cargo to Sydney first; as within a fortnight Bligh had been arrested and deposed by the New South Wales Corps mutineers, this did Berry little harm. A month or two later Colonel Johnston chartered the vessel to fetch settlers from Norfolk Island to Hobart in order to complete the evacuation of the island; the freight was to be paid in timber, but the excessive length of the voyage (owing to bad weather the round trip took 24 weeks) so increased the charge for freight that the acting-governor refused to pay it. Berry, whose sole desire at the time was to get back to the Cape with a profitable cargo, had to wait about in Port Jackson, and at last sailed for Fiji to load sandalwood. On his way he touched at the Bay of Islands in New Zealand, to get spars for his vessel, going on via Tonga to Fiji (where he was for a time a prisoner), and then returning to New Zealand; there he heard that a big English vessel had been captured and looted at Whangaroa, and was able to rescue the four survivors of the transport *Boyd* (for the full story see NEW ZEALAND). Then, loading up with spars for naval use at the Cape, he started eastwards on 26 January 1810. Storms almost shattered the vessel off Tierra del Fuego, and in despair Berry made along the Chilean coast to Valparaiso and Callao, where he procured a fresh cargo and started for Cadiz. This time he rounded the Horn safely, and visited Rio on the way; but near the Azores the vessel was found to be leaking beyond repair and had to be abandoned. Making his way first to the Azores, then to Lisbon, and thence to Cadiz, he witnessed Soult's bombard-

ment of that city in 1812, caught the yellow fever there, made a lifelong friend of Edward Wollstonecraft (afterwards his partner and brother-in-law), and on his way thence to England was captured by a Yankee privateer.

Such an adventurous youth could hardly be expected to lapse into sober English commercialism. In 1819 Berry and Wollstonecraft decided to settle in Australia. Chartering a vessel, Berry took out a cargo and did so well with it that Macquarie early in 1820 described him as 'an eminent merchant . . . . well acquainted with the present state and resources of this colony.' Wollstonecraft (who had come out independently) stayed on in Sydney and secured from Macquarie a 500-acre grant on North Shore which he named 'Crow's Nest;' Berry returned to England, chartered another vessel, and in it brought out Governor Brisbane and his staff. The Crow's Nest grant was all very well for the residence of a Sydney merchant, but did not suit Berry's pioneer temperament; he therefore left his partner to look after the commercial side of the partnership in Sydney (where Wollstonecraft became senior director of the Bank of New South Wales and a prominent member of the chamber of commerce), and obtained from Brisbane a 10,000-acre grant in the Shoalhaven district, where he settled under Coolangatta Hill. The district was at that time practically inaccessible overland, and quite unapproachable by the mouth of the Shoalhaven River, so that Berry had to cut a canal from the river to a little haven south of it (known as Crookhaven) before any real settlement could be begun. Access once given, however, the Shoalhaven district became very popular, and in 1826 Berry and Wollstonecraft were forced to give public notice 'that they have not opened a Public Tavern at Shoalhaven.'

That was the end of Berry's adventures. For the rest of his life—nearly 50 years—he devoted himself to developing the Shoalhaven estates, which he enlarged to 80 square miles by purchase, and to the management of the Sydney business after Wollstonecraft's death in 1832. As this necessitated continued absences from the estate, in 1836 he fetched from Scotland his brothers David and John to take over the control of the Shoalhaven property. He himself had been appointed to the legislative council in January 1829, held the post till 1843, when he was nominated to the new council, and when that was dissolved in 1856 became a member of the first legislative council under responsible government. When in 1861 the majority of members of that council resigned, Berry, who was one of them, retired into private life, and gave all the more attention to his estates; it is mainly his work that the Shoalhaven district—which Oxley had reported on as useless owing to its swampy nature—was developed to its present state of prosperity. He died at Crow's Nest on 17 September 1873.

Berry, Sir Graham (1822-1904), born at Twickenham near London on 28 August 1822, educated at Chelsea and apprenticed to a Chelsea draper, about 1848 opened a small shop in the King's Road; but the prospects of better business at the Victorian goldfields induced him in 1852 to migrate to Melbourne. He did not, however, pass through to the diggings, but opened a greengrocer's shop (which afterwards expanded into a general store and wine-shop) near the intersection of Chapel-street and Toorak-road. In 1860 he purchased the *Collingwood Observer*, entered politics, and was elected by chance for East Melbourne, but at the general elections of 1861 stood for Collingwood as an advanced protectionist and held the seat until 1865. During the angry debates on 'tacking' provoked by McCulloch (q.v.) Berry opposed all unconstitutional measures, and was ejected from Collingwood and rejected for the Murray Boroughs by McCulloch's excited followers. In 1866, therefore, he left Melbourne for Geelong, bought and amalgamated the Geelong *Register* and *Advertiser*, edited the new paper, and in 1868 was returned for Geelong West. In 1870 he joined the short-lived Macpherson ministry as treasurer, but his budget failed to balance, and the ministry went out; McCulloch, who was the next premier, proposed a property tax, and Berry attacked him on behalf of the manufacturers, while Duffy (q.v.) espoused the cause of the agriculturists; the joint attack was successful, and on 19 June 1871 Berry joined Duffy's ministry as treasurer and minister for customs. This meant the triumph of protection, and Berry might have held the ministry together and dominated parliament for some years, had not his appointment of his father-in-law to a minor office raised an outcry against him personally that drove him out of the government in May 1872.

For the next few years education, not the tariff, was the problem of current politics, and Berry was in obscurity. But in 1874 James Service became treasurer of the Kerferd ministry, and in the session of 1875 attempted to lower several duties. Berry at once came to the fore, drove the ministry from office, and himself took the premiership in a hostile parliament, though McCulloch and Kerferd, combining forces, ousted him after two months' tenure and as a coalition saw the parliament through its term. Berry stumped the country against them, and did his best to 'stonewall' business inside the legislature, and the elections of 1877 showed that the country was behind him. He was returned with a large majority at his back (60 to 26), and at once introduced or promised a number of highly controversial measures—particularly a land tax intended to break up large estates, a permanent provision for the payment of members (which had hitherto been effected by a series of temporary acts), and a drastic 'reform' of the legislative council. The land tax was carried in the council, but the bill for payment of members was blocked, and attempts to 'tack' it to the appropriation bill also failed. The situation now resembled that produced by McCulloch over an early tariff; but Berry, who had quarrelled with McCulloch over his unconstitutional methods of evading that crisis, could not now follow his example. Instead of allowing creditors of the government to sue for their money, he cut the knot by wholesale dismissals (see Black Wednesday) of county court judges, police magistrates, goldfields wardens, permanent heads of important departments, and officials of like calibre. This action brought about a compromise by which the obnoxious 'tack' was abandoned, but payment of members was authorized for the term of the parliament, and most of the dismissed officials were reinstated. Berry's next move was an attempt to extend the franchise of council electors and diminish the council's powers; that body, of course, rejected his bill, and he then proceeded, accompanied by Charles Pearson (q.v.), to England as an 'embassy' from the majority of Victorian electors

to ask the British parliament to alter the colony's constitution. His mission was a failure from the outset. His best supporter, Sir George Bowen (who as governor had approved and aided most of his drastic actions), was recalled, and Sir M. Hicks Beach, then colonial secretary, refused to amend the Victorian constitution by British act, seeing that the power of amendment had been deliberately surrendered to the colonial legislature in 1855. On Berry's return to Victoria he was defeated in the assembly and heavily overthrown at the ensuing elections. But James Service, his successor, in his turn tried his hand at council reform, produced a measure that the assembly rejected as insufficient, appealed to the country a second time within five months, and found that he had brought Berry back to power. This time he managed to pass (in 1881) a bill that nearly trebled the number of council electors, shortened its term, increased its membership from 30 to 42, and in other ways slightly modernized it. Success, however, was fatal to him, and within a fortnight after the passage of the bill he was defeated in the assembly and succeeded by Sir B. O'Loghlen at the head of a moderate and peace-loving ministry, too weak to effect (even if it had wished to do so) any important changes. For two years the country enjoyed a welcome rest; then the elections of 1883, fought on no particular party cry, swept away the moderates and sent back Berry and Service with about the same number of followers. A coalition was obviously the best way out, and although Service had refused to join Berry in 1880, Berry wisely agreed to join his former opponent and leave him the nominal premiership. The results were excellent. Both leaders were able to select the best of their followers for office, instead of having to fill up the minor offices with extremists—Alfred Deakin, for instance, was thus brought in by Berry—and, the hotly controversial questions having been disposed of, time was given for useful legislation like the public service act (establishing entrance by examination and control by a non-political board) and the railways management act, which similarly removed the construction and control of railways from political interference. A discipline act that to some extent organized the colony's defence, a mallee lands act that threw open to farmers millions of acres in the north-western corner of the colony, and a water conservation act that encouraged the development of the Murray valley lands by irrigation, were other products of this useful coalition.

By this time, however, Berry was ageing, and weary of political life. In February 1886 he resigned office to take the colony's agent-generalship in London (as Service retired at the same moment, a new coalition had to be constructed, Gillies taking Service's place and Deakin Berry's). As agent-general the new official, along with Service, Deakin, and Lorimer, represented Victoria at the colonial conference of 1887. Quiet work in a London office, however, did not suit him for long. In 1892 he handed over the agent-generalship to James Munro, returned to Melbourne, and took the treasurership under Munro's colleague William Shiels; but the financial crisis of 1892-3 was already impending, two banks with which Berry was closely connected had closed their doors even before he took office, and in January 1893 the Shiels ministry disappeared to make room for one more trusted by the mercantile community. When this ministry also failed to master the situation, it was expelled on 28 August 1894 by George Turner (who had been minister for customs under Shiels), and he very wisely provided for Berry's absence from the political combat by making him speaker of the assembly. This post he held until in 1897 he lost his seat in parliament; then he retired on a pension of £500 a year, and died at Melbourne on 25 January 1904. During his last years—in 1891 and 1897-8—he represented Victoria at the two great federal conventions, but left no mark on them. (K.C.M.G., 1886.)

Bevan, Llewelyn David (1842-1918), born at Llanelly in Carmarthenshire, Wales, on 11 September 1842 and educated at University College school and the university of London (B.A., 1862; LL.B., 1865), began his ministry as colleague of Dr. Thomas Binney at the Weigh House chapel in London, at the same time assisting from 1866 to 1876 in the work of the Working Men's College that F. D. Maurice had founded in 1854, and becoming a member of the London school board (1873-6). In 1874 he visited the United States, in 1876 became for a time pastor of the Brick Presbyterian church in New York, and in 1880 was moderator of the New York presbytery. Returning to London in 1882, he was made minister of the Congregational church at Highbury Quadrant, and thought of entering politics; three seats in Wales and one in North London were put at his disposal. In 1886, however, he was invited by the members of the Congregational church in Collins-street, Melbourne, to become their pastor; he accepted, and worked there for 23 years, moving in 1909 to Adelaide to become the first principal of the Parkin training college for Congregational ministers. He died in Adelaide on 19 July 1918.

Outside his ministerial duties Bevan had two great interests, education and the welfare of the workers. At the Melbourne international exhibition of 1888 he was chairman of the jury of education, and was decorated for his work by the French government, and in 1891 was commissioned by the Victorian government to study the educational systems of France, Germany, and the United States. During the London dockers' strike of 1889 he organized a public meeting, under the auspices of the Congregational Union and the Trades Hall council, to raise funds for the families of the strikers; in 1892 he was one of the promoters of a scheme for labour colonies. He was also a strenuous worker for Australian federation. In his own Church he was chairman of the Victorian Union in 1887-8, and vice-president of the international councils at London in 1891 and Boston in 1899.

Beyeria, a genus of the family Euphorbiaceae, containing 13 species (all endemic in Australia) of shrubs with more or less glutinous leaves. The flowers are unisexual. *B. viscosa*, the Pink-wood of Tasmania, is a tall shrub. At times a resinous substance exudes abundantly from its leaves. The wood is used for sheaves of blocks and turnery; it is remarkable for hardness, and for uniformity of colour—a pale reddish mahogany—and of grain.

Biddy-biddy Burr. See Acaena.

Bidens, a genus of the family Compositae, consisting chiefly of weedy herbs, widely distributed throughout Australia. Its floral bracts are few, in 2-3 rows; fruits flattened or 4-angled, surmounted by a pappus of 2-4 rigid

awns set with reversed bristles, by which they cling to the coats of animals. In *B. pilosus* the white rays of the marginal florets are only occasionally developed—though this is a common occurrence in plants growing in the Port Jackson district of New South Wales.

Bidwill, JOHN CARNE (1815-1853), born at Exeter in England in 1815, in 1838 migrated to Australia. His original purpose is not certain; he was vaguely connected with a Sydney firm, but had also a desire to settle on the land, and was able, while awaiting the survey of a block of land he had selected at a great distance from Sydney, to visit New Zealand and investigate the botany of the Bay of Islands district. Recalled to Sydney by his firm, he was sent back to New Zealand in 1840, this time to Port Nicholson, and renewed his botanical researches there. These visits resulted in the publication of a delightful book, *Rambles in New Zealand* (London, 1841). From Port Nicholson the firm sent him to Moreton Bay in what is now Queensland, and he there discovered and described the Bunya-bunya Pine (*Araucaria Bidwilli*), specimens and seeds of which he took to England in 1843. By 1844 he was back in New South Wales, and in 1845 visited Tahiti, where he vainly attempted to acclimatize passion-fruit. He was by this time well known as an expert botanist, highly thought of by Sir Joseph Hooker and intimate with P. P. King, William Macarthur and the Macleays; and on 1 September 1847 Governor Fitzroy made him government botanist of New South Wales and first director of the Sydney botanic gardens. Unfortunately the colonial office had independently nominated Charles Moore to that position, and on his arrival in January 1849 Bidwill had to vacate it, but was at his own suggestion made commissioner of crown lands at Wide Bay. Here he continued his botanical studies, but while surveying a road from his district across the thickly wooded ranges towards Moreton Bay was lost in the bush for eight days, and on 16 March 1853 died at Tinana (now a suburb of Maryborough) from the effects of this and similar hardships. While at the Sydney gardens he experimented widely in hybridization, especially with *Amaryllis* and *Hibiscus*.

Bigge, JOHN THOMAS (1780-1843), born at Linden in Northumberland on 8 March 1780, educated at Westminster School and Christ Church College, Oxford (B.A., 1801; M.A., 1804), and admitted to the bar at the Inner Temple in 1806, was in 1815 appointed by the colonial office chief justice of Trinidad. When therefore in 1818 that office, worried by the complaints of the disgruntled free settlers and the perpetual nagging of Jeffery Hart Bent (q.v.), needed a commissioner to investigate the affairs of New South Wales and report on Macquarie's administration and the real value of the colony, Bigge—who had just returned from Trinidad—was selected and given almost dictatorial powers. Macquarie was instructed to make 'an early, if not an immediate, adoption' of any recommendations Bigge might put forward, and was warned that in disregarding them he would incur 'heavy responsibility.' Taking with him as his secretary Thomas Hobbes Scott (q.v.), Bigge on 30 April 1819 left England in the *John Barry*, and reached Sydney on 25 September; within a month he showed his hand by objecting to Macquarie's appointment of William Redfern, an emancipist, to the magistracy, and from that time onwards there was constant friction between them. Bigge at one time declined all further private intercourse with Macquarie; only Scott's persistence healed the breach, and only that because within a few days Bigge left Sydney for Hobart. For the rest of his visit to the various settlements peace was preserved, though some of his suggestions concerning the limitation of building (a matter which was much at Macquarie's heart) must have tried the governor rather severely. On 14 February 1821, after a 17-months' stay in the colony, Bigge returned to England in the *Dromedary*, and set about the preparation of his reports; but the first (on the convict system) did not reach the British authorities until 6 May 1822, the second (on the colony's judicial establishments) was sent to them late in the same year, and the third (on agriculture, trade, religion, finance, land-grants, etc.) is dated 10 January 1823. It thus fell to Brisbane to carry out the huge mass of recommendations, most of which were accepted by Bathurst without alteration, though he was wise enough to give Brisbane a discretion about their immediate adoption or postponement. The constitutional reforms Bigge recommended are dealt with under CONSTITUTIONS, and those relating to the convict system under CONVICTS; for the rest, he vehemently condemned Macquarie's lenience towards emancipists, blamed him for spending too much money on buildings, but otherwise gave a cold approval to his administration. Shortly after Bigge's return he was entrusted with a similar mission to the Cape Colony, and, going there with fewer prejudices and taking a longer time over his investigations, produced better work. In 1830 he was investigating the Hottentot problem in South Africa. Of his later years little is known, but it appears that he died in 1843. His three reports, whatever may be thought of their recommendations, are a valuable—indeed, indispensable—store of facts concerning life and its conditions in the New South Wales of 1819-21.

Bilharzia. See BLOOD-FLUKES.

Bird-lice. See BITING-LICE.

Bird of Paradise. See RIFLE-BIRD.

Birds of Australia. This article deals with (*a*) the birds noticed by early discoverers, (*b*) the history of Australian ornithology, (*c*) the composition and relationships of the local avifauna, (*d*) distribution and migration, (*e*) songs and calls, (*f*) plumage and coloration, (*g*) special habits, and (*h*) the influence of white settlement on their numbers and distribution. A bibliography is appended.

Early Discoveries.—The first record of Australian birds is contained in a letter of Haevick Claeszoon van Hillegom of the ship *Seewolf* to the manager of the Dutch East India Company. He says that on 5 May 1618, in S. latitude 28° 26', he saw a number of birds 'such as a white tern and a few ternlets,' so that he surmised that he was near the land. Altering his course to the northward he sighted the North-west Cape of Australia six days later.

Several other Dutch mariners on voyages to Java subsequently observed sea-birds on the west coast, and Jan Carstenszoon's journal records that he saw herons, water curlews and other wild-fowl in 1623 on the western coast of the Cape York peninsula; but the first to meet with an Australian land-bird was Francis Pelsart, whose ship, the *Batavia*, was wrecked on Houtman's Abrolhos in 1629. On the two

largest islands of the group, now called the Wallaby Islands, he saw 'a number of grey turtle-doves,'—i.e. brush bronze-wing pigeons.

William Dampier, who landed at Cygnet Bay in King Sound in 1688, reported that there were 'a few small Land-birds, but none bigger than a Blackbird, and but few Sea-fowls.'

In 1697 Willem de Vlamingh discovered a river on which were pelicans, shags, divers, and black swans, and named it the Swan River. In the trees on its banks were cockatoos and parrakeets, and 'the song of the nightingale' (reed-warbler?) was heard. Farther north he saw 'footprints of the cassowary' (emu) and in Shark Bay several very large nests (probably of sea-eagles).

On Dampier's second visit to Australia, in 1699, he landed first at Dirk Hartog Island, where 'there were but few Land-fowls; we saw none but Eagles, of the larger sorts of Birds; but 5 or 6 sorts of small Birds. The biggest sort of these were not bigger than Larks; some no bigger than Wrens, all singing with great variety of fine shrill Notes; and we saw some of their Nests with young Ones in them.' On Rosemary Island, one of the Dampier Archipelago, he saw 'a few small Land Birds, and a sort of white Parrots, which flew a great many together' (bare-eyed cockatoos). Of his final landing-place in Roebuck Bay he records: 'The Land-fowls that we saw here were Crows (just such as ours in *England*) small Hawks, and Kites; a few of each sort; but here are plenty of small Turtle-Doves, that are plump, fat and very good Meat. Here are 2 or 3 sorts of smaller Birds, some as big as Larks, some less; but not many of either sort.'

During his voyage along the north-west coast Dampier met with pelicans, cormorants, gulls, gannets, boobies, man-of-war birds, galdens (herons) and curlews. He gives special descriptions of certain sea-birds which struck him as new; these seem to have been the Caspian tern, crested tern, brown-winged tern, pied oyster-catcher, straw-necked ibis and red-necked avocet. The four last-named are figured in the account of his travels—the first published pictures of Australian birds. The oyster-catcher and avocet are readily recognizable, but the identity of the tern and ibis are more doubtful.

Nothing further was added to the knowledge of Australian birds until Captain Cook, with the naturalists Banks and Solander, landed in Botany Bay in May 1770. No connected account of the natural history discoveries made on this voyage was ever published. Banks in his *Journal* (which was not published till 1896) gives the following account of the birds met with on the coast of New Holland. 'Of sea-fowl there were several species; gulls, shags, solan geese or gannets of two sorts, boobies, etc., and pelicans of an enormous size; but these last, though we saw many thousands of them, were so shy that we never got one, as were the cranes also, of which we saw several very large and some beautiful species. In the rivers were ducks which flew in very large flocks, but were very hard to come at; and on the beach were curlews of several sorts, some very like our English ones, and many small beach birds.

'The land birds were crows, very like if not quite the same as our English ones, most beautiful parrots and parroquets, white and black cockatoos, pigeons, beautiful doves, bustards and many others which did not at all resemble those of Europe. Most of these were extremely shy, so that it was with difficulty that we shot any of them. A crow in England, though in general sufficiently wary, is, I must say, a fool to a New Holland crow, and the same may be said of almost all if not all the birds in this country. The only ones we ever got in any plenty were pigeons, of which we met large flocks, and of which the men who were sent out on purpose would sometimes kill ten or twelve a day. They were beautiful birds, crested differently from any other pigeons I have seen' (i.e. top-knot pigeons). 'What can be the reason of this extraordinary shyness in the birds is difficult to say, unless perhaps the Indians are very clever in deceiving them, which we have very little reason to suppose . . . . Yet one of our people saw a white cockatoo in their possession, which very bird we looked upon to be one of the wariest of them all.'

In addition to the birds mentioned in this summary, Banks notes in his *Journal* that at Botany Bay they shot 'loryquets,' and quails very like those in England; on the Endeavour River they saw whistling ducks; and on Eagle Island in the Barrier Reef found an eagle's nest containing young birds, 'and another I knew not of what bird, built on the ground, of a most enormous magnitude,' 26 feet round and 32 inches high—probably that of an osprey.

In February 1772 a French expedition under Marion du Fresne landed at Frederick Henry Bay, Tasmania. From the journal of Crozet, the chief officer, we learn that the crew 'killed some ravens similar to those in France, some blackbirds, thrushes, turtle-doves' (brush bronze-wing pigeons), 'a parrakeet resembling a South American one in plumage with white beak. They killed all sorts of sea-birds, especially pelicans, and a black bird with red beak and feet, and which Abel Tasman mentions in his journal' (black oyster-catcher).

Captain Cook on his last voyage landed at Adventure Bay, Tasmania, in January 1777. He records 'several sorts of birds, but all so scarce and shy, that they are evidently harassed by the natives, who perhaps draw much of their subsistence from them. In the woods the principal sorts are large brown hawks or eagles, crows nearly the same as ours in England, yellowish paroquets and large pigeons. There are also three or four small birds, one of which is of the thrush kind. On the shore were several common and sea-gulls, a few black oyster-catchers or sea-pies, and a pretty plover of a stone colour, with a black hood (hooded dotterel). About the lake behind the beach, a few wild ducks were seen; and some shags used to perch upon the high leaf-less trees near the shore.' Among the small birds referred to by Cook were the well-known blue wren, the striped diamond-bird and the 'blue jay' (black-faced cuckoo-shrike) the latter being probably the bird of the thrush kind he mentions.

History of Australian Ornithology.—The first scientific descriptions of Australian birds were based on drawings and descriptions—in a few cases on skins—taken to Europe by various members of the expeditions alluded to above or by the first settlers. By the year 1801 about 120 Australian birds were known to naturalists, the majority having been described by the leading English ornithologist of the period, Dr. John Latham. Of the paintings used by Latham in this work a duplicate set, with slight differences, is preserved in the British museum; it is known as the Watling drawings, one of the artists having been Thomas Watling (see ART). It is certain that these drawings, which number

295, were the work of several different hands; many are excellent pictures, but a certain number are so unlike any known bird that it is impossible to guess what species they are intended to represent. Sometimes there are three or four pictures of the same species, of varying merit. As a consequence Latham's descriptions cannot always be identified, and he sometimes gave separate names to what we now know were duplicate pictures of the same bird. Out of the 171 names which he bestowed nearly 100 are still in use.

In 1813 John Lewin published in Sydney a book (illustrated with hand-coloured engravings) called the *Birds of New South Wales*, which is of interest as the first separate work on Australian ornithology. He only described four species that had not been previously named by Latham.

The next ornithologists to deal with Australian birds were mainly foreigners. The Frenchman Vieillot in the years 1816-1819 wrote the ornithological articles for the *Nouveau Dictionnaire d'Histoire Naturelle*, and there described many Australian birds collected by various French exploring expeditions, particularly those obtained by Péron and Lesueur on Baudin's expedition. Of some 70 birds thought by him to be undescribed more than half had been previously named by English writers, but about 25 species are now known by his names. A year or two later Temminck's work on the pigeons of the world named most of the Australian species, and Kuhl, who published a book on parrots, named many Australian species for the first time.

In 1827 Vigors and Horsfield made a study of the collection of Australian birds in the possession of the Linnean Society of London. It seems probable that a great part of this collection had been procured for Sir Joseph Banks by George Caley (q.v.)—at all events Vigors and Horsfield were able to quote from Caley's notes on the habits of the birds, and to give their aboriginal names. Their paper gives us some idea of the birds found about Sydney in very early days and, as might be anticipated, shows that some species then common in the district are now almost unknown there. About 25 species were described as new, and a number of forms were recognized as generic types peculiar to Australia. It is to Vigors and Horsfield, and to some extent to Vieillot, that the first attempts to classify Australian birds must be credited.

The extremely important work of John Gould is described under his name; it need only be said here that since the publication in 1865 of his *Handbook to the Birds of Australia* only about 100 new species have been discovered, and many of these are rare or casual visitors from oversea. The progress of Australian ornithological literature since Gould is sufficiently indicated in the bibliography attached to this article.

Composition and Relationships of the Australian Avifauna.—The total number of species of birds admitted to the official list compiled by a committee of the Royal Australasian Ornithologists' Union is 712. Larger numbers have been given previously, but in accordance with modern views a number of geographical races or forms, only differing slightly, are now regarded as subspecies instead of being given full specific rank.

Of the 712 species 6 are probably extinct, and 42 have been met with on so few occasions that their exact status is not known—most seem to be merely casual or irregular visitors, 48 are regular visitors which do not breed in Australia, and 616 have been found breeding.

The 48 regular visitors include 18 sea-birds which breed farther south and visit Australian coasts during winter, and 30 birds which breed in north-eastern Asia and visit Australia during summer (the northern winter); 28 of these are waders (q.v.) and the other 2 swifts (q.v.).

The 616 species which breed in Australia are grouped in 286 genera in the list already mentioned. The classification of these genera into families is by no means settled, since a large proportion of our birds have not yet been studied anatomically. The latest classification, that of Mathews and Iredale, appears to the writer to be the most satisfactory yet proposed.

The 616 species are arranged by them in 99 families. In the following table these species, genera and families are grouped according to their distribution:—

Distribution.	Species.	Genera.	Families.
Not found outside Australia	431 (= 70%)	107 (= 37%)	11 (= 11%)
Found in other parts of the Australian region (Moluccas, New Guinea, New Caledonia, or New Zealand)	122 (= 20%)	64 (= 22%)	17 (= 17%)
Found in the oriental region (tropical Asia or Malay Is.)	26 (= 4%)	33 (= 12%)	7 (= 7%)
Widely distributed in the eastern hemisphere	19 (= 3%)	30 (= 10%)	17 (= 17%)
Found in the warmer parts of both hemispheres	.....	4 (= 1%)	3 (= 3%)
Cosmopolitan (or absent only from South America)	9 (= 1%)	35 (= 12%)	38 (= 38%)
Oceanic, widespread in tropical or southern seas	9 (= 1%)	13 (= 5%)	6 (= 6%)

Omitting oceanic birds, 54 species, 102 genera, and 65 families of Australian birds are found outside the Australian region, and it is noteworthy that every one of these, without exception, is found also in southern Asia. It is evident, therefore, that a large part of the present avifauna of Australia has reached this continent at different periods from that region. In some cases the birds have undergone so much modification as to be ranked as generically distinct, in other cases only as distinct species; in 54 cases only slight sub-specific modifications have taken place. Probably the slow influx of Asiatic birds via the Malayan and Papuan islands is still in progress. The fact that 90 per cent of our species and 59 per cent of our genera are peculiar to the Australian region indicates the length of time during which Australia has been isolated from Asia.

Since it is the members of the families peculiar

to the Australian region that give the special character to our avifauna, these are here enumerated. The 11 families peculiar to Australia are:—Dromaeidae (emus), Cereopsidae (Cape Barren goose), Anseranatidae (magpie goose), Pezoporidae (ground parrots), Polytelitidae (long-tailed parrots), Leptolophidae (cockatoo parrot), Menuridae (lyre-birds), Atrichornithidae (scrub-birds), Falcunculidae (shrike-tits), Sphenostomidae (white-faces and wedge-bill), Pardalotidae (diamond-birds). The 17 other families peculiar to the Australian region, and represented in Australia, are:—Casuariidae (cassowaries), Megapodiidae (mound-builders), Platycercidae (broad-tailed parrots), Loriidae (lory-parrots), Cacatuidae (cockatoos), Proboscigeridae (palm cockatoo), Trichoglossidae (lorikeets), Opopsittidae (lorilets), Scythropidae (channelbill), Podargidae (frogmouths), Aegothelidae (owlet nightjars), Sphecotheridae (figbirds), Orthonycidae (log-runners), Cracticidae (butcher-birds and magpies), Meliphagidae (honey-eaters), Ptilonorhynchidae (bower-birds), and Paradiseidae (birds of paradise).

A number of these families only contain one or a few species but the broad-tailed parrots, cockatoos, lorikeets, butcher-birds, magpies, diamond-birds, honey-eaters and bower-birds are among the best represented families in our fauna, the honey-eaters being the most numerous family. One or more species of each of these last-mentioned families is present in almost every part of the continent.

The peculiar families are presumably representative of the earliest forms of bird life which reached Australia, and it is therefore of interest to enquire whether they give any clue as to the origin of those forms. The various peculiar families of parrots and of perching birds, together with the channelbill, undoubtedly have their nearest relatives in the old world. The megapodes are generally regarded as coming nearest to the curassows of tropical America. No definite pronouncement can be made as to the lyre-birds, scrub-birds, frogmouths and the two anomalous geese, but it has been suggested that the emu and cassowary have their nearest living relatives in the South American rheas. It would seem probable that whereas the majority of Australia's peculiar birds are descended from ancestors hailing from Asia, the megapodes may be descendants of a curassow-like bird which made its way across the Pacific from one island group to another, and that the cassowary and emu, with the extinct New Zealand moas, are ancient types which originated in the southern hemisphere before the land which formerly connected Australasia with South America across the Antarctic continent sank beneath the ocean.

Distribution and Migration.—Within Australia three very distinct ornithological regions may be distinguished, the Torresian, the Bassian and the Eyrean. The Torresian fauna has its richest development in north-eastern Queensland, extending thence along the coast westward to the Kimberley division of Western Australia and southward to northern New South Wales. Among the birds confined to this region are the cassowary, scrub-fowl, brush turkey, jabiru, crested hawk, coucal and sunbird. Pigmy-geese, figparrots, pittas, log-runners, figbirds and riflebirds are unknown in other parts of Australia, and it is far richer than the other regions in fruit-pigeons, bower-birds and flycatchers. Most of the characteristic Torresian birds either extend to New Guinea or have close relatives therein, 71 per cent of the genera occurring also in the Papuan region. The Bassian fauna has its richest development in the coastal districts of southern New South Wales, Victoria and South Australia, extending also to Tasmania and the south-western corner of Western Australia. Forms peculiar to it are the Cape Barren goose, mountain duck, ground parrot, pilotbird and bell miner; lyre-birds, scrub-birds, bristle-birds, spinebills, wattle-birds and robins (*Petroica*) are characteristic. Some of the latter extend northward into southern and central Queensland, there being a considerable overlapping of Torresian and Bassian forms in this part of the continent; the Torresian birds are mostly confined to the scrubs and the Bassian species found in open bush country.

The Eyrean region comprises the whole of the rest of the continent. In the arid regions of the centre and north-west birds are comparatively few; but all round the edges of the region, in the pastoral areas of the various States, birds are specially numerous. Among the noteworthy Eyrean birds are the mallee-fowl, plain wanderer, cockatiel, budgerigar, red-backed kingfisher, white-winged chough and grey jumper; characteristic types are the bare-eyed cockatoos, grasswrens, ground-birds, scrub-robins, ground-wrens and white-faces, and grass-finches and groundpigeons are specially numerous.

Comparatively few species are found all over the continent. Among these are the emu (which is thus specially suitable as a national emblem), bronze-wing pigeon, white-fronted heron and several other waterfowl, black swan, black duck, grey teal, bustard, tawny frogmouth, magpie-lark, wagtail, wedge-tailed eagle, and several hawks and owls.

It has been mentioned above that 48 species from other regions visit Australia regularly during the season when their breeding-grounds are frozen. The 30 which come from the northern hemisphere form part of the great wave of birds which annually flows to and from the north polar lands, and about which so much has been written. It is interesting to note that genuine migration on a small scale occurs also among southern birds. Eighteen sea-birds that breed on islands farther south regularly visit our southern coasts during winter, and some of the oceanic birds that breed off our coast (notably the mutton-bird of Bass Strait) apparently actually cross the equator into the North Pacific during the southern winter.

In the Bassian region a considerable number of insectivorous birds migrate northwards for the winter. From Tasmania and parts of Victoria the welcome swallow, tree swallow, and wood swallow disappear in the autumn, though in the more northern parts of the region some members of these species are resident. The reed-warbler, dollar-bird, bee-eater, two species of caterpillar-eaters and four species of flycatchers, leave the Bassian region altogether in winter and apparently migrate to the extreme north of Australia, the majority crossing Torres Straits into New Guinea. We have at present little evidence as to the routes followed by most of these birds or their exact wintering-grounds; great flights of bee-eaters, however, are seen crossing Torres Straits northward in the autumn and southward in the spring.

That many insectivorous birds should leave Tasmania and southern Australia during the winter does not seem surprising. It is more remarkable that from the Torresian region also there is a considerable migration northward

for the winter months. The most noteworthy of these migrants are the nutmeg pigeon and the shining starling. So long ago as 1842 Jukes, the naturalist in H.M.S. *Fly*, expressed surprise that birds should leave the tropical forests of northern Queensland for those of New Guinea. 'In these latitudes' he says 'mere temperature cannot be the cause of it, although the variations of the seasons for different fruits or insects may.'

The type of migration which Seebohm called gipsy migration is very characteristic of Australia, especially of the Eyrean region. In dry seasons large numbers of Eyrean birds travel outwards from the interior, and may appear in quantities even on the coast. Immense flocks of black-tailed native hens occasionally invade the suburbs of Perth and Adelaide, and white-browed wood swallows are in some years abundant near Melbourne. In some cases it is difficult to draw the line between gipsy movements and true migrations. Most of the Australian cuckoos apparently pass the winter in the Eyrean region, invading the coastal districts during the breeding-season; their numbers appear to fluctuate somewhat according to the season. The four species, however, which regularly visit Tasmania must there be regarded as true migrants. The two species of song-larks travel annually southward into the Bassian region for the breeding-season, but their abundance varies greatly in different years; apparently when there is plenty of grass in the Eyrean region the majority remain there to breed, and only a few migrate. Other well-known gipsy migrants are the chats, the cockatiel and the budgerigar.

Gipsy migration forms a link between true migration and mere local movements. The flame-breasted robin, which breeds in Tasmania and the mountainous parts of Victoria and New South Wales, winters in western Victoria and South Australia for the most part, though a few remain in sheltered localities near the breeding-grounds. It is certain that great numbers cross annually from Tasmania to the mainland. The rose-breasted robin, which breeds in the mountains of Victoria and New South Wales, travels to the lower country on the east coast in the winter, when many also appear in southern Queensland. In many other species the birds that breed in mountainous or bleak situations move away in winter, probably to the north, whereas those frequenting sheltered valleys and the coastal plains remain in them all the year round.

Properly conducted ringing experiments on a large scale, such as are now in vogue in the United States and Europe, are badly needed in Australia to elucidate the movements of the birds. A study of migration on the comparatively small scale on which it occurs here would probably throw light on the origins of the extraordinary movements of birds witnessed in the northern hemisphere.

Songs and Calls of Australian Birds.—Gordon's well-known reference to Australia as a land of 'songless bright birds' has constantly been taken to mean that all Australian birds are songless, whereas in the writer's opinion he referred merely to the fact that parrots—his 'bright birds'—could not sing. Whatever may have been the poet's meaning, it is certain that Australian birds as a whole are by no means songless. It is probably true that the number of songsters of the first rank is smaller in proportion than in Europe and North America, nor do we enjoy such an outpouring of song as that which marks the spring months in those northern countries; on the other hand the number of Australian birds with melodious songs is at least equal to that found in any other country, and, owing to the lack of inclement winter, the majority of our birds sing throughout the year, though their outpourings are more continuous in the breeding-season.

There is little doubt that the first place amongst our singing birds must be given to the lyre-bird; its own notes are loud, clear and harmonious, its song is well-sustained, and it further shows a wonderful capacity for incorporating in its song the themes of other birds as well as various sounds that it has heard in the bush. The reed-warbler, brown honey-eater, white-shouldered caterpillar-eater, striped honey-eater, bush-lark and song-larks, though their range of notes is much less, rank high owing to the continuity of their efforts and the rapidity with which they pour out their notes, conveying an impression of passionate intensity. The shrike-thrushes, yellow robins, thickheads, and magpies are more accomplished musicians, with a greater command of notes and many passages of beauty, but lacking in fire. Other birds with pleasing songs are the brown flycatcher, fly-eaters, and silver-eyes.

The bush-lark and song-larks sing in the air, like the well-known skylark of England; and the pipit and grass-warbler, though their songs are much inferior, resemble them in this habit. The white-shouldered caterpillar-eater and striped honey-eater habitually sing in tree-tops and often, appearing to be carried away by their own exuberance, leave their perches and float horizontally through the air, singing all the time.

A number of Australian birds utter decidedly melodious calls, which cannot be classed as songs. The most notable of these are the two bell-birds, the crested bell-bird of the Eyrean region and the bell miner of the coastal districts of the south-east. Other striking call-notes are those of the coachwhip-bird, ending in a sound like the crack of a whip; the koel, resembling the familiar cooee; the pallid cuckoo, whistling eagle, channelbill and magpie-lark. The most famous, and perhaps the most remarkable, call of any of our birds is the loud laugh of the laughing jackass; the collared butcher-bird also has a call resembling a laugh. Curious grunting or booming notes are made by the emu, cassowary, bittern, frogmouth and coucal. Most of the cockatoos and parrots utter loud screams, but the remarkable ground parrot appears to be absolutely silent. Of nocturnal calls the 'more pork' call of the boobook owl is the most familiar, and some of the rarer owls utter strange notes at night. The weird and mournful call of the stone-curlew is also usually uttered at night. On moonlight nights the wagtail and the bush-lark, may not infrequently be heard singing. Finally, we may mention the strange song of the restless flycatcher, often uttered while the bird is hovering in the air, which strongly resembles the sound made in sharpening a knife-blade on a grindstone.

The lyre-bird is by no means the only mimic amongst our birds; the spotted bower-bird is also wonderfully clever, and the habit is also possessed by the orioles and rufous scrub-bird. In captivity most species of white cockatoos learn to mimic the human voice as well as other sounds; many Australian parrots, and the magpies, can be taught to whistle tunes.

Plumage and Coloration.—The majority of Australian birds have all the feathers of their plumage normal, but there are a few exceptions. The emu and cassowary have double feathers (see EMU); in the cassowary these are hair-like, but in the emu bear lateral barbs, widely spread on the shaft, which do not interlock—hence the feathers are termed 'disintegrated.' Similarly disintegrated feathers occur in the tails of lyre-birds and emu-wrens, and constitute the nuptial plumes of egrets. The feathers of penguins are scale-like.

Lengthened feathers or plumes occur on the neck of the straw-necked ibis, on the sides of the breast of whistling-ducks, and (in the breeding-season) on the backs of egrets. A pair of long, narrow plumes hangs from the back of the head of the nankeen night heron; in tropic-birds, the white-tailed kingfisher, the bee-eater and the long-tailed grass-finch, two of the central tail-feathers are elongated and project much beyond the others. The whole of the tail of the lyre-bird (q.v.) consists of modified plumes.

Australian birds with lengthened or modified feathers forming a crest on the head are the crested penguin, which has a row of long plumes on each side of the crown; the great crested grebe, which has a tuft on each side of the crown as well as a ruff round the neck; the top-knot pigeon, with one tuft before and the other behind the crown; the cockatoos, whose crests can be raised or lowered at will; the plumed pigeons, crested pigeon, crested hawk, cockatiel, shrike-tits, crested bell-bird, wedge-bill and golden bower-bird, whose crests are much more rigid than those of cockatoos; and the wood-duck, laughing jackass and bush-lark, the feathers of whose crests are not greatly lengthened.

Many honey-eaters have tufts of specially silky or spiny feathers on the cheeks; the white-eyes have a ring of small silky feathers round the eye; the rifle-birds have feathers with a metallic iridescence on the breast; and most ducks and bronze-wing pigeons have a patch of iridescent feathers (speculum) on the wings. In almost all the cases mentioned the modified feathers are coloured differently from those of the adjacent parts, rendering them specially ornamental. Several Australian birds have the whole or part of the head naked. In the ibises and friar-birds the naked parts of the head are black, in the scrub turkey they are red, and in the emu and cassowary blue. Naked patches round the eye occur in the bare-eyed cockatoos and blue-faced honey-eater (where they are blue), in the palm cockatoo, channelbill and figbird (where they are red), and in the cormorants, where they are variously coloured.

Fleshy, pendent wattles are present on the cheeks of the spur-winged plovers and yellow wattle-bird (where they are yellow), on the cheeks of the red wattle-bird (where they are red), on the edge of the gape of the wattled honey-eater (where they are purple), and on the sides of the neck of the cassowary, where they are orange. The jacana has a fleshy comb of a bright rose colour; the leatherhead and helmeted friar-bird have black leathery protuberances on the upper mandible of the beak; the musk duck has a leathery flap hanging from the lower mandible. Smooth horny plates on the forehead occur in some of the rails; in the moorhens and bald coots they are scarlet, and in the coot white.

The proportion of brilliantly plumaged birds in the Australian avifauna is at least as great as in any other region; the highest percentage occurs among the Torresian birds which inhabit the tropical and subtropical scrubs and brushes. Families of which almost all the members are brilliantly clad are the parrots, lorikeets, fruit-pigeons, kingfishers, bee-eaters, pittas and finches. Many honey-eaters and flycatchers are also adorned with bright colours. Among robins, thickheads, wrens, chats, mistletoe-bird, sun-bird, bower-birds, and rifle-birds the males are nearly always brightly coloured, but the females are mostly clad in sober hues. Except the birds just mentioned few show any great difference in coloration between the sexes; among them are the king quail, blue-billed duck, darter, gang-gang cockatoo, log-runners, figbirds, caterpillar-eaters and some of the flycatchers. In most hawks the female is a good deal larger than the male, but male musk ducks and song-larks are much larger than the females. It is remarkable that in almost all the Australian ducks the sexes are similar; this is in striking contrast to what is found in the northern hemisphere, where the drakes of most species are much more brightly coloured than the ducks during the breeding-season.

In most of the birds mentioned above, where the males are more brilliant than the females, the young males—in their first year at least—resemble the females, and some robins, thickheads and wrens at times breed when still in immature plumage. The male satin bower-bird is said to be seven years old before it acquires its complete adult plumage, and it is believed that the regent and Newton bower-birds also take some years to attain full coloration.

In the albatrosses, gannets, gulls, and probably the terns, both sexes acquire a plumage in their first year which is much darker than that of the adult; in the wandering albatross, gannets and Pacific gull the complete adult plumage is apparently not attained for several years.

In many owls, frogmouths and hawks of general brownish plumage there is a great deal of variation in colouring, which does not seem to depend either on age or on geographical distribution. In the brown hawk two distinct forms have been regarded by many writers as distinct species, but intermediates are not uncommon. In the giant petrel, reef heron and grey goshawk white and coloured forms co-exist, though in the two last-named many authors regard the white forms as distinct species. They are not albinos, since their eyes, bills and legs are pigmented, and where they are found in company with the coloured forms they interbreed freely. It is curious that in each case the geographical ranges of the two forms are different; in the giant petrel and reef heron white forms are only found in part of the range of the coloured ones, but the white goshawk has a wider range than the grey, being the only form found in Tasmania and north-western Australia. Dimorphism also occurs in the coucal and black butcher-bird, which have black and brown phases.

A very noticeable feature of Australian bird-life is the predominance of birds with strikingly contrasted black and white plumage. Though the number of species exhibiting this coloration is not very great, most of them are among the commonest and most widespread forms. They include the magpies, butcher-birds, bell-magpies, chough, magpie-lark, caterpillar-eaters, restless flycatcher, wagtail and hooded robin. All these, except perhaps the last, are very bold, pugnacious birds which do not hesitate to attack birds much larger and more powerful than themselves, such

as crows and hawks. They are mostly more or less sociable, though frequently fighting and chasing one another about. It seems clear that this black-and-white style of colouring is an example of warning coloration.

Special Habits of Australian Birds.—It is probable that most of the ornaments described in the preceding section are displayed by their wearers in special ways during courtship. Comparatively few observations on this subject seem to be on record. The male bustards display before the hens in a manner similar to that of the domestic turkey-cock; the male musk duck, when displaying, lowers his head till the flap under the bill is in contact with the water, utters a loud whistle or 'ponk' and at the same moment splashes up the water behind him with his feet; and the male lyre-bird scratches up a mound of earth on which he sings, dances and raises his wonderful tail, while the hen birds watch from amongst the surrounding bushes and ferns. Native companions assemble in flocks and perform strange evolutions that resemble dancing. But the most remarkable type of play is that of the bower-birds (q.v.) which construct bowers round which they collect bones, shells, berries and bright objects of various kinds. The fantails constantly spread the fan-like tail from which they derive their name, and some robins have a habit of drooping their wings; both these actions are indulged in at all seasons, not only during courtship. The crested hawk and the dollar-bird, when flying, frequently tumble in the air like tumbler-pigeons. The nankeen kestrel, black-shouldered kite, brown hawk and restless fly-catcher are able to hover, remaining stationary in the air with rapidly beating wings, while they scan the ground beneath them for food.

Australian birds, like those of other countries, differ greatly in nest-building capacity; some species merely deposit their eggs on the ground; others excavate holes or utilize natural cavities, and others form nests of sticks, grass or fibres of different kinds. Three species—the magpie-lark, chough and grey jumper—build large, basin-shaped nests of mud; the welcome swallow also makes a mud-nest; fairy martins build bottle-shaped mud-nests which are attached in groups to cliffs or houses. Of open, cup-shaped nests those of the robins, white-eyes, most honey-eaters, tree-runners and fantails are the most beautifully formed, the latter being remarkable for the construction of a tail of loose material left hanging. Builders of domed nests include the lyre-birds, wrens, tits and scrub-wrens, the most beautiful structures being those of the mistletoe-bird and sunbird. The crested bell-bird has the curious habit of decorating its nest with hairy caterpillars; the rifle-bird usually twines the cast skin of a snake round its nest. The yellow-rumped tit builds a domed nest containing two cavities; the lower one is lined and utilized for the eggs, and the upper appears to be a sleeping-place for the cock-bird. Babblers build large numbers of domed stick-nests, only a few of which are lined and utilized for breeding purposes.

The laughing jackass and several other species of kingfishers almost always bore a hole in an arboreal termites' nest in localities where these occur; the white-tailed kingfisher and beautiful parrakeet utilize terrestrial termite-mounds for the same purpose.

Most remarkable of all are the great mounds of earth and leaves scratchd up by megapodes (see MOUND-BIRDS), in which the eggs are placed and hatched as in incubators. Australian cuckoos, with the exception of the coucal, deposit their eggs in the nests of other birds (see CUCKOO). Most of the sea-birds, petrels, albatrosses, penguins, gulls, terns, cormorants and pelicans nest in great colonies usually on islands off the coast; many swamp-birds, such as ibises, spoonbills and egrets are also sociable when breeding, constructing nests of sticks in close proximity in trees and bushes growing in the water. The shining starling also breeds in colonies, dozens of their hanging nests being constructed in the branches of some large tree.

A number of Australian birds pretend to be wounded when their nests or young are approached, and flutter along the ground in an effort to decoy the intruder from the locality. This habit is most marked among the ducks, plovers, and chats, but is sometimes exhibited by birds of other families.

The bitterns when alarmed freeze into a rigid attitude, with the long neck and beak pointing straight upwards and the wings pressed close to the sides. In this attitude they are very inconspicuous among the reeds which they frequent. The stone-curlew and frogmouths also adopt a rigid attitude for concealment, the neck being stretched out in front and the eyes almost closed. The curlew crouches on the ground, the frogmouth rests lengthwise on a bough; in these positions their mottled plumage gives them a striking resemblance to a dead bough.

The sordid wood-swallow has the extraordinary habit of roosting in a cluster, the birds hanging on to one another like bees in a swarm.

Influence of White Settlement.—There is no doubt that the settlement of Australia has had a very considerable influence on bird life. The most direct effect is due to the shooting of various species for food or for sport. The birds most sought after by Australian sportsmen are ducks, quail, pigeons, plovers and the bustard. Except in the most closely settled districts these birds do not appear to have decreased very seriously, so that shooting is probably by no means the most important element in the diminution of Australia's bird life. The almost complete disappearance of magpie geese from south-eastern Australia may, however, be due to this cause.

The effect of poison has probably been more serious. In most pastoral areas very large numbers of wedge-tailed eagles have been destroyed by poison-baits intended for dingoes. The poisoning of rabbits has also had a serious effect on certain birds, such as magpies, in some districts.

The fencing of land for pastoral purposes has been very destructive to emus, which have often been prevented from reaching water in times of drought: many, too, are shot because it is believed that they eat too much grass and spread prickly pear.

The periodical burning of pastoral land to improve the grass has probably caused great destruction to ground-nesting birds, though it is difficult to tell how much of the diminution in numbers of the more terrestrial birds is due to fires and how much to the introduction of foxes and cats. Probably these last animals have had the most serious effect of any agent introduced by white men. Certain birds, especially those which nest in holes, have been driven out of parts of south-eastern Australia by the competition of the introduced sparrow and starling, the latter often utilizing all the suitable nesting holes.

The clearing of forest land, especially of the subtropical brushes of northern New South Wales, has almost succeeded in exterminating

certain types of birds that are confined to such habitats, e.g. the Albert lyre-bird.

On the other hand white settlement has undoubtedly increased the numbers of certain species. In the first place the disappearance of the aboriginal, who in the proper season lived largely on the eggs of certain waterfowl that breed in colonies, has enabled many of these birds to breed without interference, and the number of egrets and ibises is probably increasing. Secondly, the clearing of land for agricultural purposes, and the construction of dams throughout the agricultural districts, have greatly benefited birds like the ground-lark, plover, magpie-lark and some others which prefer open country. Probably the familiar wagtail should also be included in this class, as it does not appear to have been a very common bird—at all events near Sydney—when the first settlers arrived.

The foregoing influences are probably the most important; but others, more obscure, may be equally far-reaching. It must not be forgotten, also, that apart altogether from human influence changes are constantly taking place in nature, some species decreasing naturally and others steadily increasing. The study of these changes, and the attempt to arrive at the reasons which favour one species at the expense of another, will always remain a most difficult and fascinating problem for the ornithologist.

Since the settlement of Australia five or six species of birds appear to have become extinct. Of these the small emus of Kangaroo Island and King Island, and the Tasmanian form of the common emu, were certainly destroyed by white settlers. The causes of the disappearance of certain other birds such as the noisy scrub-bird and black-throated coachwhip-bird of Western Australia, the beautiful parrakeet of Queensland, and the night parrot of the spinifex country of the interior, are very doubtful. It is possible that they are not yet quite extinct, but there is evidently no hope of their revival. Some naturalists attribute their disappearance to cats and bush-fires; to the writer it seems probable that they were on the borderland of extinction before the arrival of white settlers. It is noteworthy that several other species of parrots—e.g. the little fig-parrots—have become very scarce even in localities where the scrubs which they frequented have not been greatly disturbed, and such forest-haunting birds, living on fruits in the tree-tops, are out of reach of cats or fires.

While the gradual extinction of some species is taking place, others are undoubtedly still extending their ranges. Tasmania appears to have gained during the past century the white-fronted chat, white-necked heron, white egret and little pied cormorant; south-western Australia has gained the straw-necked ibis, white egret and black-breasted plover. The laughing jackass has been introduced into both these States by human agency, and has become thoroughly acclimatized.

See Lewin's *Birds of New South Wales* (Sydney, 1813); Gould's *Synopsis of the Birds of Australia* (1837-8), *Birds of Australia* (7 vols., 1841-8), and *Handbook of the Birds of Australia* (1865); Diggles's *Ornithology of Australia* (Brisbane, 1866-70); Ramsay's *Tabular List of the Birds of Australia* (2nd edn., 1888); Broinowski's *Birds of Australia* (Melbourne, 1890-1); Hall's *Key to the Birds of Australia* (2nd edn., 1899); Campbell's *Nests and Eggs of Australian Birds* (Sheffield, 1901); North's *Nests and Eggs of Birds Found Breeding in Australia* (Sydney, 1901-14); Hall's *Useful Birds of Southern Australia* (Melbourne, 1907); Mathews's *Birds of Australia* (in course of publication), and *List of the Birds of Australia* (1913); Littler's *Handbook of the Birds of Tasmania* (Launceston, 1910); Lucas & Le Souef's *Birds of Australia* (Melbourne, 1911); Mathews & Iredale's *Manual of the Birds of Australia* (in course of publication); Leach's *Australian Bird Book* (5th edn., Melbourne, 1923); the *Official Check-list of the Birds of Australia* issued by the Royal Australasian Ornithologists' Union; and files of the *Emu* (quarterly since 1901), the *South Australian Ornithologist*, and the *Austral Avian Record* (irregularly since 1912).

W.B.A.

Bird's-nest Fern. See FERNS.

Bismuth. Australia was at one time the second largest producer of bismuth in the world, Bolivia coming first. The chief commercial deposits of this metal occur at Kingsgate in the Glen Innes district, and Whipstick in the Pambula district, both in New South Wales. A small quantity has also been mined in northern Queensland and Tasmania. The low-grade ore used to be treated in Sydney, but rich ore was shipped abroad; in recent years, owing to the lack of a market, very little has been treated locally. The method of concentration for the smelters depends on the quantity to be treated and the associated minerals. If the quantity is small, it may be hand-picked, broken up, and concentrated in sluices or on hand-jigs. Larger quantities, that warrant a mechanical plant, are crushed by rock-breakers and rolls, and concentrated in May jigs and on some form of table. For ores associated with molybdenum and wolfram, see under those headings.

Bismuth is mostly used to form alloys with other metals, e.g. copper, tin, lead, and antimony. Small quantities added to lead make it tough: an alloy of two parts of bismuth with three parts of lead is ten times as hard as the pure lead and 20 times as tenacious. Bismuth and antimony form an alloy which expands when changing from the molten to the solid state. Bismuth and tin form a very sonorous alloy, and in consequence many bell-metals have bismuth added to them. Quicksilver absorbs a large quantity of bismuth, and the amalgam thus formed is used for silvering mirrors. Alloys containing bismuth which are fusible at different temperatures are used for obtaining the exact degree of heat for tempering steel. Safety-plugs for automatic fire-sprinklers are made of a bismuth alloy, as also sometimes are electric fuses. Bismuth-bronzes are said to be unoxidizable, to keep a good colour and to be easily polished. Bismuth subnitrate is used in surgical operations, as a medicine, in porcelain painting, and as a cosmetic. The carbonate, oxychloride, salicylate, gallate, lactate, and other organic compounds of bismuth are also used in medicine and surgery. The chief impurities in bismuth are arsenic (which is objectionable when the metal is required for medicinal purposes), tellurium, antimony, copper, and sulphur.

F.D.P.

Biting-lice, also known as bird-lice, small insects of the order Mallophaga, dorso-ventrally flattened parasites without wings, which infest birds and mammals. They have short antennae, with three to five joints; strongly developed mandibles, short legs, and a thorax in which all three segments remain quite distinct. They are rather closely related to the Psocoptera, and may be regarded as a specialized offshoot from near the base of that order, the assumption of parasitism being the principal cause of the evolution of the new ordinal characters. About 120 species are recorded from Australia, nearly one-third of which have been introduced.

The order is divided into two sub-orders, according to the form and position of the antennae.

In the sub-order Amblycera the antennae are four-jointed, more or less clubbed at the tip, and concealed. The maxillary palpi are four-jointed. L. Harrison divides them into six families. The majority of the lice found upon marsupials belong to this sub-order. Among these we may mention the Kangaroo Louse (*Heterodoxus macropus*), and the species of *Boöpia* and *Latumcephalum* found upon wallabies and wombats. All the above belong to the family Boöpidae. The other families infest birds; the best-known genera in Australia are *Eomenopon* (found upon lorikeets), *Ricinus, Colpocephalum, Tetrophthalmus,* and *Menopon.* To the last-named genus belongs the common introduced chicken-louse, *M. gallinae.*

In the sub-order Ischnocera the antennae are either three- or five-jointed, of slender form, and exposed. Maxillary palpi are absent. L. Harrison recognizes three families. Of these the Trichodectidae include species parasitic upon mammals, such as *Trichodectes pilosus,* found on the horse, *T. bovis* on the ox, and *T. ovis* on the sheep; all these have been introduced into Australia with their hosts. The Philopteridae infest birds. The best-known Australian genera are *Philopterus, Lipeurus, Goniocotes, Degeeriella,* and *Rallicola.*

See articles by Johnston and Harrison in the *Proceedings* of the Royal Society of Queensland, 1912, and by Harrison in *Parasitology,* 1916.

R.J.T.

Bitter-bark. See ALSTONIA.

Bitterns. See HERONS, EGRETS, AND BITTERNS.

Blackall. SAMUEL WENSLEY (1809-1871), eldest son of Major Robert Blackall of the East India Company's service, was born in Ireland on 1 May 1809, educated at Trinity College, Dublin, and served in the regular army and the Irish militia. From 1847 to 1851 he represented Longford in the house of commons; he then served under the colonial office as lieutenant-governor of Dominica (1851-7), governor of Sierra Leone (1862-5), governor-in-chief of the West African settlements (1865-7), and governor of Queensland (1868-71). During his tenure of office in Queensland he paid special attention to agriculture and education, interesting himself particularly in linking up the grammar schools of Queensland with the university of Sydney. He died in harness on 2 January 1871, and was buried at Toowong. He was a tactful administrator at a difficult period of the history of the colony.

Blackberry. See RUBUS and NOXIOUS PLANTS.

Black-bird. See THRUSHES.

Black-caps. See HONEY-EATERS.

Black Drummer. See BLACKFISH.

Blackfish (family Girellidae), a very common market-fish (*Girella tricuspidata*) which is known under various vernacular names in the different States. In Tasmania it is the 'black bream,' and in Victoria the 'black perch,' 'rock perch' or 'ludrick;' fishermen of New South Wales call it 'blackfish,' while in New Zealand it is known as 'mangrove fish,' or 'parore.' It is herbivorous, and line-fishermen usually bait their hooks for its capture with a fine green weed known as sea-moss. It affords excellent sport to rod-fishermen, and puts up a valiant fight for its life; but the bulk of the huge quantities marketed throughout the year is captured with nets in coastal lakes and estuaries. Though not a choice fish, it commands a ready sale—notwithstanding the fact that, like all other weed-eating fishes, it must be cleaned soon after capture lest it become tainted by the weed decomposing within it. Dentition differs in the two sexes, the male having three rounded lobes on the edge of each tooth, while in the female the teeth are chisel-edged. The reason for this is not apparent, but it is so characteristic that the two forms have been generally supposed to represent distinct species. The blackfish is silver-grey in life, tinged with bronze, and has about 12 dark-grey bands descending from the back across the sides. Incipient albino specimens of this and allied species, brilliantly and almost uniformly yellow in colour, are occasionally captured.

Rock Blackfish or Black Drummer (*Girella elevata*) is closely allied to the preceding species, and is not uncommon, though very little has been recorded of its habits or distribution. It is also a weed-eater, but prefers the so-called sea-cabbage. The dentition of the two sexes is the same. It is known only from the neighbourhood of Sydney, where it lives among rocks on the coast, and can be captured with hook and line or with the trammel net. Bluefish, another allied species, is dealt with separately under that name.

River or Slippery Blackfish (*Gadopsis marmoratus*) occurs in some streams in Tasmania and Victoria, and in the New South Wales part of the Murray River system. It is of much interest to naturalists, being the only member of its family (Gadopsidae), and is evidently a highly specialized percoid fish, though its relationships are obscure. It is said to attain a length of 24 inches in the southern States, and is both a good food and game fish. A.R.McC.

Blackham, JOHN MCCARTHY, born in Victoria on 11 May 1855, entered first-class cricket in the intercolonial match of 1874, when he stumped one New South Wales batsman and caught three at the wicket. In 1877 he kept wicket in the first Australia *v.* England test match, and out of the 38 matches that followed played in all but four—three in 1885 and one in 1887. In the first match against Stoddart's team of 1894-5 he was badly hurt, and had to retire permanently from cricket. His ability as a wicket-keeper was remarkable, and he set a new standard for that post, standing up to the fastest bowling, rarely allowing a bye. In his 35 test matches he stumped 24 men and caught 36. In 1884, at Lords against the Gentlemen of England, he stumped three men in succession. He captained the Australian elevens which played Lord Sheffield's team in 1892 and the Australian team of 1893, but was too easily worried to be an ideal captain; during the 1892 matches he admitted losing a stone in weight from anxiety. Incidentally, while captain he invariably put himself in last man, a position only once given him by another captain. It is worth record that he was taken to England with the team of 1878 as second wicket-keeper only, W. L. Murdoch (q.v.) usually keeping wicket for the team. See CRICKET.

Blackthorn. See PITTOSPORACEAE.

Black Thursday, 6 February 1851, the day on which an immense tract of country in Victoria was laid waste by one of the most disastrous bush fires known in Australia. Its origin

was ascribed to the carelessness of some bullock-drivers in the Plenty Ranges, but it seems incredible that any fire could have spread so rapidly from a single source. The flames covered almost simultaneously the country round Western Port, the Dandenong forests, and the ranges thence to Mount Macedon and the Barrabool Hills; then, spreading from the Black Forest across the Loddon district, they crossed the Pyrenees and in the end attacked Mount Gambier beyond the South Australian border. The loss of life was unexpectedly small, but that of property was enormous. In Melbourne, owing to a scorching north wind, ashes from Mount Macedon fell in the streets, which were full of dense smoke, and the thermometer at 11 a.m. registered 117°. A full and vivid account of the disaster is given in Turner's *History of Victoria*, i. 331-3.

Black Trackers, aboriginals attached to the police force in several Australian States, who are employed chiefly in tracking criminals and lost persons in outlying districts. The earliest known official reference to the use of aboriginals for this purpose occurs in a memorial of the legislative council (dated 6 September 1825) to Governor Brisbane on the suppression of bushranging; the council recommended that 'small parties composed of three or four soldiers and one or two natives, under the direction of one constable for each party,' should be stationed on the main roads out of Sydney to track and secure highway robbers. Brisbane forwarded this memorial to Bathurst, who ignored the recommendation; but Darling in March 1826 issued a general police order in which he suggested that the most intelligent natives should be attached to police parties. In the hunt for escaped convicts and early bushrangers trackers were used both in New South Wales and Tasmania—the best known being Musquito (q.v.) of the Broken Bay tribe, who was transported to Tasmania in 1813 and for some years afterwards employed to track down bushrangers, including the notorious Michael Howe.

So valuable were the trackers in police work against the aboriginal tribes that in 1838 an effort was made in the Port Phillip district to raise a native police force—a course that had been suggested by Alexander Maconochie (q.v.) as advantageous to the natives themselves. In 1841 Captain Dana, with the assistance of the tribal chiefs, succeeded in organizing a native corps which performed its duties until his death in 1852. It was then disbanded, as the use of these 'Joes' in the mining district excited much opposition. In Queensland a native mounted-police corps was recruited in 1848 by the explorer Frederick Walker; it was disbanded after a few years' service, during which the troopers were responsible for much wholesale slaughter among the aboriginal tribes, but reorganized in 1857 and maintained until 1900, when it was finally disbanded. Troopers were allowed to re-engage as native trackers attached to the general police force. The services of these Queensland troopers were at times engaged by the other States for tracking purposes—the most notable instance being the engagement by Victoria of six troopers under Sub-inspector O'Connor in the hunt for the Kelly gang. The other States, too, recruited native trackers for their regular police forces. 'Sir Watkin,' of the New South Wales force, at the age of 51 distinguished himself highly by his courage and skill during the hunt for the Clarke gang of bushrangers in 1867; he lost an arm in the final fight, and was given as a reward the honorary rank of sergeant-major.

White troopers in outlying districts have at times suffered from the treachery of their trackers, and in the early days some trackers took advantage of their official position to deal cruelly with aboriginal tribes other than their own. But under proper supervision the native police have behaved finely, and their special capacity for their work is indubitable.

In 1919 there were 39 black trackers in New South Wales; 89 in Queensland; 10 in South Australia; 45 in Western Australia; and 27 in the Northern Territory.

Black War, The. See TASMANIA.

Black Wednesday, 9 January 1878, the day (so named as a bitter parody on Black Thursday) on which the Berry ministry dismissed public officials wholesale. The Victorian legislative council had refused to pass the appropriation bill, and Sir G. Berry, on the plea that this refusal deprived him of funds wherewith to pay the officials, proceeded on the evening of 8 January to gazette the dismissal of more than 200 public servants, including county court judges, magistrates, coroners, goldfield wardens, and the heads of important departments. Many of the dismissed men only learned their fate on arrival at their offices next morning; hence 9 January became notorious, although the formal dismissals were dated Tuesday the 8th. Most of the officials were reinstated in the following April, but the opportunity was taken to get rid of several who had made themselves obnoxious to Sir G. Berry. For his assent to this arbitrary act Sir George Bowen, then governor of the colony, was severely reproved by the British government and soon afterwards removed to the Mauritius.

Blackwood. See ACACIA.

Bland, WILLIAM (1789-1868), born in London on 5 November 1789 and educated at Merchant Taylors' school (his name, however, does not appear in the school register), was trained for the medical profession by his father—himself a specialist in obstetrics—and in January 1809 became a surgeon (5th rate) in the navy. In 1813, while serving in H. M. sloop *Hesper* on the East Indies stations, he became involved in a quarrel with the purser; on 7 April a duel was fought at Bombay, which resulted in the purser's death and Bland's trial at Calcutta for murder. The verdict of 'guilty' was accompanied by a strong recommendation to mercy, so that Bland was sentenced only to seven years' transportation. Reaching Sydney early in 1814, he almost immediately received a free pardon, and began to practise his profession, which brought him into contact with the Wentworths and Redfern; from that time he was a close friend and supporter of W. C. Wentworth both in his personal and in his public campaigns. Among the pleasures of this 'younger set' was that of lampooning dignitaries, and occasionally the lampoon had a wider circulation. In 1816 W. C. Wentworth lampooned Colonel Molle (q.v.), and escaped the consequences by going to England; in 1818 Bland, suffering at the time from the unfaithfulness of his wife, lampooned Macquarie and was less lucky—a fine of £50 and 12 months' imprisonment were his punishment. On emergence from prison in 1819 he steadied down, and devoted himself to philanthropic and public affairs. He took special interest in the benevolent asylum, which had been established

by Samuel Leigh (q.v.) and others in 1818; he joined the committee that in 1825 founded the Sydney free grammar school; in 1828 he tried to resuscitate the school, and was its treasurer from 1835 onwards; he was active in resisting Darling's attempt to revive the censorship of the press; and when in 1835 Wentworth founded the Australian Patriotic Association Bland was its secretary, and helped Wentworth to draft two bills for a 'representative' constitution which were submitted to the British government. When the representative constitution of 1842 came into force, Bland was returned along with Wentworth to represent the city of Sydney; he held the seat until 1848, in the ensuing election was defeated by Robert Lowe, but when Lowe resigned in November 1849 regained the seat and held it for another seven months, pressure of professional business then compelling him to leave politics. Under the constitution of 1856 he entered the council as a nominee on 23 March 1858, but vacated his seat on 21 March 1861. He died on 21 July 1868.

It is probable that in the early twenties he visited England, as in 1823 he was passed by the royal college of surgeons as naval assistant surgeon, and in 1826 obtained the rank of naval surgeon; but we have no other evidence for this visit. His work for the Patriotic Association was of great public value. In 1849, while out of the legislature, he republished a series of letters to Charles Buller—written in the name of the association, and signed by Jamison and Wentworth as well as himself—full of valuable information about the constitutional struggle of 1839-41, as well as about the relative values of transportation and free immigration as sources of labour supply. In the same volume (*Letters to Charles Buller . . . . by William Bland*, Sydney, 1849) are contained an attack on the Wakefield theories and the two draft bills mentioned above. In the same year Wentworth introduced into the legislature a bill to create the university of Sydney, and named Bland—who was at the moment chairman of trustees of the Sydney College—as one of the first senators; Lowe (who had not long before ousted him from the council) raked up against him the conviction of 1813, said that no ex-convict ought to be appointed to the senate, and on that issue secured the failure of the bill. Bland at once told him he was a liar and a scoundrel, and in effect challenged him to a duel (see DUELLING); but Lowe evaded the issue, and when the bill was re-introduced Bland's name—tactfully but regretfully—was omitted from it. For Bland's researches into the construction of dirigible balloons see AVIATION.

Blandfordia. See CHRISTMAS BELLS.

Blanket-plants. See LACHNOSTACHYS.

Blaxland, JOHN (1769-1845), head of one of the most notable pioneer families of Australia, was born at Hemphall near Fordwich in Kent on 4 January 1769, educated at King's School, Canterbury, and trained for the army, rising to the rank of captain in the Duke of York's cavalry. On his father's death he succeeded to the family estates in Kent, and retired from the army to live at Newington near Chatham; but in 1805 he with his younger brother Gregory (on the advice of Sir J. Banks) decided to migrate to New South Wales, and, promising to employ there at least £6000, was allowed by Lord Castlereagh 8000 acres of land, the use of 80 convicts for 18 months at government expense, and free passages and freight for his family and goods—so anxious was the British government at that time to encourage free settlement in the new colony. Gregory came out first, reaching Sydney on 14 April 1806, and at once fell foul of King; it would seem that the Blaxlands felt they were a boon to the colony, while the old naval governors, fully occupied with attempts to maintain discipline, resented the intrusion of free men to whom their disciplinary code could not be applied. John complicated matters still further by taking passage in a whaler of his own, instead of accepting the free government passage, so that Bligh was ordered to give him extra concessions on arrival—an order which Bligh disliked exceedingly. John reached Sydney on 3 April 1807, and by October was deep in Bligh's black books; he 'cared for nothing but making money,' wrote the indignant governor—he bought cheap and sold dear—he dealt in milk and fat cattle instead of farming—instead of using 80 convicts for 18 months, he proposed to use 20 for six years. Bligh's animosity, indeed, was so well known that after the mutiny Johnston at once made Blaxland a magistrate, and was much irritated when his appointee—who obviously wanted only to be granted his rights and allowed to carry on his business—joined with Simeon Lord in objecting to many of Johnston's and Macarthur's proceedings. To protest at headquarters against his treatment by both Bligh and Johnston, John Blaxland sailed for England in September 1808, but on arrival at Cape Town was arrested as one of the mutineers and badly treated. However, during an enforced stay of three years in England (where he was detained to give evidence at Johnston's trial) he managed to convince the authorities that he had been unjustly dealt with, and Macquarie was ordered to carry out in full the original agreement. This he did with much grumbling, his trouble being that cattle-rearing, which the Blaxlands preferred, was less profitable to the colony as a whole than wheat-growing. This ill-feeling endured throughout Macquarie's term of office; yet in a report on his enemies within the colony the governor classed the Blaxlands as 'discontented' only, while Marsden, Oxley, and Jamison were 'discontented and intriguing'—a sufficient proof that John Blaxland, then as from the first, was merely anxious to carry on his business and did not entangle himself in the many quarrels and intrigues of the time. In 1822, however, he became involved in the dispute over Dr. Douglass which troubled Brisbane's term and caused that governor's retirement, being one of the five magistrates whom Brisbane dismissed; so his claims against the colonial government were not settled until Darling's time. Darling then nominated him to the legislative council, in which he sat from 30 January 1829 till its dissolution on 5 January 1843. In July of the same year he was nominated to the new council, but resigned on 13 September 1844, and died at Newington, near Sydney, on 5 August 1845.

John Blaxland was thus one of the few early settlers to dissociate himself as far as possible from local politics. His object in life was to develop his properties and businesses; at Luddenham near the Nepean and near Broke on the Wollombi he bred and fattened cattle which were slaughtered and salted down at Newington, his headquarters on the Parramatta River. His establishment of salt-pans at this place was of very great value to the colony at large. He was as truly a pioneer in cattle-raising as Macarthur was in sheep. But the family

name has gained more renown from a single —but very important—achievement of his younger brother GREGORY BLAXLAND (1778-1853), born at Newington in Kent on 27 June 1778, who by arrangement with John, as already recorded, left England on 1 September 1805, reached Sydney in the following April, and settled at South Creek near Penrith. His relations with the governors for the most part resembled those of his brother; but there was one period soon after Macquarie's arrival (while John was in England attending to the family grievances and Gregory was quietly managing the New South Wales estates) when he enjoyed cordial relations with Macquarie. Gregory in the partnership looked after the breeding of cattle up-country, and in the course of his work explored the gorges of the Nepean above Penrith and interested the governor in the problem of breaking through the Blue Mountains barrier. It was, therefore, with Macquarie's assent and help that in May 1813 he led the first party across the range (see EXPLORATION BY LAND and LAWSON, WILLIAM) and on return received, as did his fellow-travellers, a grant of 1000 acres to be selected in the newly discovered region. But by this time Macquarie, at odds with John Blaxland over the matters already discussed, had taken a dislike to the whole family, and Gregory's achievement never received from him the official notice that was its due. As for the grant of land, Gregory had no wish to settle beyond the mountains; he at first inclined to select a block near Wollongong, but in 1816 sold his privilege for 5s. per acre to John Connell, who had the land located behind Cronulla. Gregory now settled at Brush Farm on the Parramatta, which he had acquired some years earlier. Here he planted a vineyard with vines from the Cape and made the first Australian wine—he gained medals for it from the Royal Society of Arts in England in 1823 (silver) and 1828 (gold); he also experimented with cattle and sheep fodders, and introduced the cultivation of oats for hay and of buffalo-grass. In July 1825 he established saltpans at Newcastle, but these were shut down in May 1827. In January 1827 he was chosen by 'The Third Grand Colonial Assembly of Australia' —that is, by a representative public meeting in Sydney—to take to England and present to the house of commons a petition demanding trial by jury and representative government. His later years are obscure; he is known to have lived for a time at Wollun near Denman on the upper Hunter, but finally settled on the ridge above Ryde, near Parramatta, where he died on 1 January 1853.

Blaze Tree. See CHRISTMAS BUSH.

Blennies, a group of fishes (Blenniidae) represented in Australian waters by many species which are usually too small to merit the attention of fishermen, though their strange and varied forms and habits render them of much interest to naturalists. A number are able to leave the water at low tide and scramble over moist rocks in search of food, the rays of their ventral, anal, and pectoral fins being commonly modified to form finger-like organs with which they clamber about. Various species of *Salarias* may be observed moving over the surface of coral reefs at low tide, while the Basking Blenny (*Lepidoblennius haplodactylus*) is often seen sunning itself on weed-covered rocks on the coast near Sydney.

The Oyster Blenny (*Petroscirtes anolius*) has a long, sabre-like tooth on each side of the lower jaw, and is often found curled up within the shell of an oyster. Whether it actually destroys living oysters is uncertain, but it uses their shells as a nursery for its young, its eggs being deposited in a mass on their inner surface. Various species of weed-fishes (*Cristiceps*) have a curious crest formed by a detached portion of the dorsal fin upon the head. They are strangely marked with colours that harmonize with those of the weeds among which they live, and silver spots on the body and transparent spaces on the fins appear as splashes of light showing through the weeds, and so help to camouflage the fish from hostile observation.

A.R.McC.

Bligh, WILLIAM (1754-1817), born at Tynten in Cornwall in September 1754, entered the navy when eight years of age, and joined H.M.S. *Hunter* when he was 16. Working his way up, as most young officers then did, from the A.B. rating, he was in 1772 appointed master of the *Resolution* under Cook. In 1781 he was promoted lieutenant, saw fighting at the Dogger Bank and at Gibraltar, and in December 1787 was chosen to command the *Bounty* (215 tons), bound for Tahiti to fetch plants of the bread-fruit tree thence to the West Indies, where it was hoped they would become acclimatized. For an account of this notable voyage and its results see BOUNTY, MUTINY OF THE. Upon Bligh's return to England (14 March 1790) a second bread-fruit expedition was arranged; Bligh, promoted commander in 1789 and post-captain in 1790, was given command of the *Providence*, which, with a smaller vessel, the *Assistant*, sailed from Spithead on 3 August 1791, reached Tahiti in April of the following year, sailed from there in the following July with a cargo of bread-fruit plants, delivered it at St. Helena, St. Vincent's, and Jamaica, and returned to England in August 1793. The voyage was completed without noteworthy incident, but the bread-fruit scheme did not flourish, and the West Indian planters preferred plantains. The Society of Arts in 1794 presented him with a gold medal. Resuming his naval duties, he took command of H.M.S. *Warrior*, cruising off Ushant; he commanded the *Director* at the battle of Camperdown, and subsequently the *Glatton* at Copenhagen in 1801; for his services at this time he was personally thanked by Nelson. In 1805, at the suggestion of Sir Joseph Banks, he was appointed governor of New South Wales, and reached Sydney on 6 August 1806. The voyage was a troubled one. Bligh was nominally 'first captain' of H.M.S. *Porpoise*, which was escorting a convoy of transports; but he actually sailed in one of the transports leaving the *Porpoise* (by admiralty orders) in charge of its 'second captain,' Joseph Short. Quarrels arose; Short fired a shot across the bows of Bligh's transport to compel her to obey his signals; Bligh boarded the *Porpoise*, superseded Short, and for the rest of the voyage took command of the whole convoy. At Port Jackson this quarrel had serious consequences. Short, before leaving England, had been given permission to settle in New South Wales, with a promise of 600 acres of land. Bligh refused to regard this promise as valid, and on the complaint of two of Short's officers ousted him from command of the *Porpoise*, which he entrusted to his own son-in-law, then to Lieutenant Symons, and then to Lieutenant Kent. Short was sent to England as a prisoner in the *Buffalo*, tried by court martial in December 1807, and honourably ac-

quitted. From Bligh's arrival in the colony until he was deposed he steadily made enemies. Among his official instructions was one requiring him to put a stop to the traffic in spirits; and the New South Wales Corps (q.v.), at this time the only military force in the settlement, included among its officers some who were thus trading to considerable pecuniary advantage. Again, when Bligh landed, the principal agricultural settlements were on the banks of the Hawkesbury and Nepean; floods had done severe damage to the prisoners' farm-stock, and the legitimate system of barter that took the place of a proper currency had been seriously interfered with. Bligh, to remedy this, slaughtered government cattle and divided them among those most distressed, giving settlers orders on the public store in proportion to his estimate of their power to repay. This, of course, seriously interfered with those vested interests which had found their profit in compelling settlers to receive payment in 'rum.' Bligh also incurred a good deal of odium by bringing to trial before a court, partially constituted of their accusers, certain Irish political exiles who had voluntarily agreed to exile themselves to escape trial, and were now charged with being concerned in a revolt in New South Wales. Six of the eight accused were acquitted, and the other two convicted and punished at the triangles; but the acquitted men were still kept under arrest and treated as criminals. John Macarthur (q.v.), too, soon aroused the governor's ire. Men of their temperament were more likely to invite than to avoid the quarrel, and a series of mutual pin-pricks followed. In 1807 Bligh's bailiff, Andrew Thompson, had a dispute with Macarthur over a promissory note which Thompson refused to honour. Bligh decided in favour of the bailiff—apparently a fair judgment, if not good law. Meanwhile Bligh had revoked certain of Macarthur's leases, and found further cause of quarrel with him over the *Parramatta*; this vessel, owned by Macarthur, had left Sydney for Tahiti with a convict stowaway, who had been allowed to tranship at Tahiti and so escape. This under the port regulations involved the forfeit of a £900 bond, but Macarthur declined to pay, the naval officer refused to clear the vessel, and Macarthur thereupon abandoned her and was ordered by Atkins, the judge-advocate, to appear before him on 15 December 1807. He disobeyed the order and resisted a constable with a warrant; thereupon a bench of magistrates was summoned, he was arrested, committed to the next sitting of the Sydney criminal court (on 25 January 1808), and admitted to bail. Fresh trouble arose at once. Macarthur pressed Atkins for a dishonoured bill, complained bitterly that a man who was his debtor should be appointed to judge him, and applied for a substitute. Bligh refused; on 25 January 1808 the court was constituted of six officers of the Corps, Atkins presiding. Macarthur again protested, and his protest was upheld by the six officers. Bligh called on each officer to appear before him and answer to what practically amounted to a charge of mutiny, and asked their commanding officer to see him that afternoon. Major Johnston replied that he was ill. The next morning Bligh wrote again to Johnston, pointing out that six of his officers stood charged with treasonable practices; but before Johnston received this letter he had heard that serious trouble was afoot, and his reply was to drive hastily from his Annandale house into Sydney, and liberate Macarthur, who had been during the last few days in gaol. Macarthur at once drew up a formal petition to Johnston, 'imploring' him to arrest Bligh and take charge of the colony. (This petition, which is now in the national gallery at Sydney, is in Macarthur's handwriting, but it is certain that very few, and probable that none, of the signatures were attached until after Bligh had been arrested. When a violent measure of this kind has once been accomplished, it is comparatively easy to obtain approving signatures.) Johnston's next act, after meeting his officers and some friends at the barracks, was to send Bligh a formal demand for his resignation:—'I am called upon to execute a most painful duty' he wrote; 'you are charged by the respectable inhabitants of crimes that render you unfit to exercise the supreme authority another moment in this colony; and in that charge all the officers under my command have joined. I therefore require you, in His Majesty's sacred name, to resign your authority, and to submit to the arrest which I hereby place you under, by the advice of all my officers, and by the advice of every respectable inhabitant in the town of Sydney.' At 6 p.m. the Corps, with band and colours, was marched to government house (which then stood at what is now the corner of Phillip- and Bridge-streets) and Bligh was made prisoner. Over the exact circumstances of this arrest there has been much dispute; many witnesses declare that Bligh had concealed himself and was not found until two hours had elapsed, and Bligh himself said, at the subsequent court martial on Johnston, that his captors had a long search before they could find him. Mrs. Putland, his daughter, kept the soldiers as long as she could from entering the house. A soldier, Sutherland, swore that he found Bligh in a bedroom, behind a bed, and 'helped him over it;' another man, Marlborough, swore that he 'collared Bligh and dragged him from under it.' These are the only two witnesses who spoke upon personal knowledge—the rest was second-hand evidence. Bligh asserted that on the approach of the regiment he put on his uniform and at once began to conceal his papers, in the act of which, while stooping behind the bed, the soldiers rushed upon him.

The first act of the new government was to try Macarthur and the rest of the persons accused by Bligh. Charles Grimes, the surveyor-general, was appointed acting judge-advocate, and all the accused were promptly acquitted. On 8 February 1808 Johnston reported the whole affair to his superior officer, Lieutenant-colonel Paterson, then in charge at Port Dalrymple, and the latter ordered the *Porpoise* to be sent across at once to bring him to Sydney; but, learning that Lieutenant-colonel Foveaux (who was lieutenant-governor of Norfolk Island) was on his way to Sydney, Paterson decided to wait until the terms of Foveaux's commission were known. Foveaux reached Port Jackson in July 1808 and administered the government until Paterson's arrival in January 1809. Up to this time Bligh had been confined to government house, but on 30 January was transferred to the barracks; and on 4 February as the result of negotiations an agreement was signed by Paterson and Bligh, the latter was allowed to go on board the *Porpoise* on condition that the ship should proceed to England as soon as 'the wind and weather will admit.' Instead of doing so however, he sailed to Hobart and tried to re-establish his authority there, but on the arrival of an order from Paterson forbidding any communication with Bligh, the officer in charge, Colonel Collins, refused to acknowledge the ex-governor's author-

ity. Bligh remained on board in Tasmanian waters until the arrival of Governor Macquarie in December 1809, when he departed for England. Macquarie had instructions to reinstate Bligh as governor for 24 hours, but owing to the latter's absence from Sydney this could not be done. The persons chiefly concerned in the revolt were brought to trial in England. Along with other post-captains of his year, Bligh was due for promotion to rear-admiral of the Blue in 1810, but was not included in the gazetted list of that year because his conduct in New South Wales was still indirectly under investigation in the trial of Colonel Johnston. The promotion, however, was kept vacant for him, and on 31 July 1811—a day ahead of the other promotions of that year—he was gazetted rear-admiral, his promotion being almost immediately ante-dated to 31 July 1810. In 1812 he was made rear-admiral of the White, and on 4 June 1814 vice-admiral of the Blue; but he never hoisted his flag. In 1812 the Royal Society made him a nautical fellow. He died at Farnham House, Kent, at the age of 63 on 7 December 1817.

For years after his death, while men still lived who had taken part in the events just narrated, his character was the subject of fierce controversy. But facts recently brought to light after being hidden away for generations in state records and family papers make it possible to estimate his character with some approach to impartiality. Of his violent and imperious temper there is no doubt. The narrative of the *Bounty* mutiny, with its disclosure of his overbearing treatment of Heywood and Christian; his quarrel with Captain Short, and its sequelae; and the lenient punishment awarded by his contemporaries to naval officers whom he had court-martialled, and to the officers of the New South Wales Corps (who on the facts of the case should have been shot as mutineers); build up the irremovable impression of an uncontrolled and tyrannical disposition. As far as his struggle against the Corps is concerned, nothing but this lack of control can deprive him of our sympathy. As a military force—which after all was its nominal *raison d'etre*—the Corps could scarcely inspire respect in one of Nelson's captains; he must have considered the officers a mere assemblage of pursers' clerks, and their undeniable connection with the rum industry (which he was pledged to abolish) would but increase his contempt for them. Again, the *Bounty's* long stay at Tahiti, and the contrast between life there and in the ship, would suffice to explain the mutiny even had Bligh been less overbearing. His vile temper, in short, exaggerated but did not cause the explosions of indiscipline of which he was so often the centre, and put him in the wrong again and again when on essentials he was really in the right. At this distance of time, however, these grave defects may be acknowledged without allowing them to hide from us his excellence in other respects. He was a great navigator, bred in the school of Cook, the same that produced Vancouver, and Flinders, and King. His skill as a fighting commander is equally unquestionable. Australians must remember him as the irascible autocrat who burst out upon Macarthur, the creator of the wool industry, with 'What have I to do with your sheep, sir? Are you to have such flocks of sheep as no man ever heard of before? No, sir!' But they, and the rest of the world, may remember him too as the navigator whose skill and indomitable courage preserved the castaways of the *Bounty*, and as the man to whom Nelson, after his Copenhagen victory, could say:—'Bligh, I thank you; you have supported me nobly!'

See authorities given under BOUNTY, MUTINY OF THE. Documents concerned with the New South Wales mutiny are fully set out in the *Historical Records of New South Wales* and the *Historical Records of Australia;* and the Mitchell Library at Sydney has a fine collection of Bligh papers.

Blight-bird. See WHITE-EYES.

Blind-grass. See STYPANDRA.

Blood-bird. See HONEY-EATERS.

Blood-flukes. The trematode parasites which infest the blood-vascular system of warm-blooded vertebrates (birds and mammals) constitute a well-defined family, Schistosomidae, comprising a few genera. The species found in human beings, oxen, and certain other mammals, all belong to the genus *Schistosoma* (of which name *Bilharzia* is a synonym), while those occurring in birds have been assigned to other genera (*Bilharziella, Ornithobilharzia, Gigantobilharzia, Austrobilharzia*). The Schistosomidae are distinguished from all other trematodes by the fact that the sexes are distinct, the male worms in most cases being shorter and much broader than the more or less filiform female; they are usually found in pairs, the lateral body regions of the male being curved ventrally to form a cavity (the gynecophoric canal) in which the female lies.

Three species of Schistosomidae have been reported from Australia, two of them (*Schistosoma haematobium* and *S. mansoni*) being human parasites, while the third (*Austrobilharzia terrigalensis*) infest the portal system of the common silver gull, *Larus novae-hollandiae.* The presence in Australia of *S. haematobium* is due to the return of Australian soldiers from the South African war, parts of South Africa being badly affected with bilharzia disease (Bilharziosis, Schistosomiasis). The only locality in our continent where the parasite became endemic was a small settlement in Western Australia; a few cases were reported from it in 1912. During the war many Australian soldiers were infected in Egypt by one or other—or even both—species of *Schistosoma.* The third species able to parasitize man, *S. japonicum,* is not known to occur in Australia, its range being China and Japan; it differs from the other two in possessing a practically smooth cuticle; its egg is smaller, more rounded, and provided with a very small lateral swelling. *S. haematobium* and *S. mansoni* differ in regard to the disposition of the genital organs as well as in the shape of the eggs—which in the latter species possess each a lateral spine, while in the former each is provided with a terminal spine. The detection of ova in the excreta (urine or faeces) has a diagnostic value. The eggs of *S. japonicum* are excreted with the faeces; so, as a rule, are those of *S. mansoni;* but the eggs of *S. haematobium* usually make their exit in the urine, and only occasionally in the faeces. Eggs of *S. mansoni* are sometimes voided in the urine.

From each egg, soon after it comes in contact with water, there hatches out a ciliated embryo (miracidium), which must enter a certain kind of pond-snail before it can undergo further development. In the case of *S. mansoni,* the snails belong to the genus *Planorbis; S. haematobium* requires species of *Bullinus;* and *S. japonicum,* species of *Blanfordia.* Within

the appropriate snail there is eventually developed a tailed stage (cercaria), which on escaping into the water swims actively. This cercaria, which is the infective stage for vertebrates gains access to its host either directly through the skin during bathing or washing, or through the mouth whilst drinking. In either case the young fluke, which has by this time lost its tail, eventually reaches the blood-stream, more especially some part of the portal system—e.g. the inferior mesenteric vein and its ramifications, the vesical veins (of the bladder), and the haemorrhoidal veins (of the rectum and lower part of the intestine). It is in these veins that the adult worms are to be found, nearly always in pairs; and it is in branches of them that the eggs are laid, to be ultimately forced through the walls of the tiny vessels into the submucosa and through the mucosa of the bladder in the case of *S. haematobium* (and to a less extent *S. mansoni*), of the rectum in the case of *S. mansoni* (and to a less extent *S. haematobium*), and of the colon in the case of *S. japonicum*. During their passage the eggs injure the tissues, damaging blood capillaries as well as the epithelium of the bladder or lower intestine, and thus give rise, not only to bleeding, but to lesions, which commonly assume a papillomatous form and may even become tumour-like; these may be invaded by organisms causing suppuration. Thus vesical bilharziosis may have associated with it haematuria and a suppurating bladder; the rectal form of the disease may be accompanied by dysentery and the formation of rectal papillomata—which may even protrude through the anal opening; and in the Japanese disease ('katayama,' as it is called) there are fever, diarrhoea, and an enlargement of the liver and spleen.

The repatriation of infected soldiers may thus lead to the establishment of centres of infection. This danger, however, has been greatly minimized by the action of the defence department in maintaining touch with infected men and in treating them; and recent reports show that the majority of repatriated Australian soldiers known to have contracted bilharziosis during the war have been cured with intravenous injections of tartar emetic.

To avoid the establishment of infection centres it is imperative to prevent the access of infected urine and faeces to water, since the latter is necessary for the life-cycle of the parasite. In areas where the malady is known to be endemic the water of ponds or creeks should not be used for bathing, washing or drinking, unless either boiled or filtered and allowed to stand for at least 48 hours; the cercariae apparently being unable to live longer. Chemical treatment of such water has been suggested but the amount of material that would have to be added would make the water unpalatable. The possibility of controlling the various pond-snails liable to act as intermediate hosts, or carriers of the larval stage, is very small. It would be interesting to know what Australian gastropod molluscs can act as hosts for any of the schistosomes; but no research work on this subject has been published.

S. mansoni is widely distributed in Africa, South America, Central America, and the West Indies; *S. haematobium* in Africa and south-eastern Asia (India to Syria); *S. japonicum* in China and Japan.

See R. T. Leiper, 'Researches on Egyptian Bilharziosis,' in the *Journal* of the Royal Army Medical Corps (1915, 1916, 1918); T. Cherry, *Bilharziosis*, Bulletin of the Defence Department, Australia (1917); N. H. Fairley and P. H. Bahr, *Observations on Egyptian Bilharziosis*, Bulletin of the Defence Department, Australia (1918); W. H. Nelson, in the *Australian Medical Gazette* (November 1912, p. 482); S. J. Johnston (on *Austrobilharzia*) *Proceedings* of the Royal Society of New South Wales (1916, pp. 234-8); Mervyn Holmes, *Medical Journal of Australia* (1920).

T.H.J.

Blood-root. See HAEMODORACEAE.

Blood-sucking Flies. The habit of sucking human or animal blood is not confined to a particular species or family of flies; but, owing to their economic importance as carriers of disease-germs, etc., it is convenient to deal with most of the various blood-sucking families together. There are seven in all, but the mosquitoes (Culicidae) are discussed separately. The other families are Tabanidae, Leptidae (brachycerous flies of the sub-order Orthorrhapha), Chironomidae, Simulidae, Psychodidae (all three nemocerous flies of the same sub-order), and Muscidae, muscoid flies of the sub-order Cyclorrhapha.

The Tabanidae are usually known in Australia as March flies, elsewhere as horse-flies or gad-flies—but these names are also applied to the Oestridae. About 200 Australian species have been described, of which more than half belong to the typical genus *Tabanus*. The two sub-families, Pangoninae and Tabaninae, are distinguished by the presence or absence of apical spurs on the posterior tibiae. Of the former group the genera *Silvius* and *Buplex* contain species mostly found in northern Australia; *Osca* and *Pelecorrhyncus* are chiefly southern and eastern, the last being only found in Australia and South America. *Osca guttata*, the largest of our March flies, is not uncommon in the coastal districts of New South Wales. The Tabaninae are represented by the genus *Tabanus*, of which many species show an affinity to Asiatic and Malayan forms; those comprised in the sub-genus *Therioplectes* are almost wholly southern.

Little is known of March flies as actual carriers of disease-germs. There is good, though not conclusive, evidence for regarding them as the intermediate hosts of *Onchocerca gibsoni*, the parasite that causes worm-nodules in cattle—a common disease in northern Australia, Queensland, and northern New South Wales. In the Philippines and India these flies have been regarded with suspicion as possible carriers of *Trypanosoma evansi*, the parasite of 'surra.' In northern Africa they have been implicated as conveying the closely allied disease *m'bori* or *el-debab*, caused by *T. soudanense*. One genus (*Chrysops*), represented in Australia by two very rare species, has been proved to be the intermediate host of loa-loa, a filarial worm which infests human beings. Tabanidae may also be mechanical transmitters of disease; one species, *Buplex neocaledonica*, has been blamed in New Caledonia for transmitting anthrax.

Of the Leptidae (which are allied to the Tabanidae) five described Australian species have the blood-sucking habit; the genus *Spaniopsis* is peculiar to Australia and Tasmania, and four of the species are not uncommon near Sydney and on the Blue Mountains in the autumn. The habit of blood-sucking is rare in this family.

The blood-sucking Chironomidae (midges) belong to the genera *Culicoides* and *Leptoconops*, and are commonly known as sand-flies. About

13 Australian species have been described, though it is not certain that all are blood-suckers. *Culicoides molestus* is the common sand-fly of the New South Wales beaches.

The Psychodidae include *Phlebotomus papatasii*, the sand-fly proper of Mediterranean countries, which is a transmitter of sand-fly fever. It is represented in Australia by at least one species with blood-sucking habits (*P. queenslandi*).

The Simulidae (buffalo-gnats) are comprised in a single genus, *Simulium*, of which four Australian species have been described. These flies are numerous inland; they are not known to carry disease, but were at one time regarded as the carriers of pellagra.

One species of the Muscidae, the Stable-fly (*Stomoxys calcitrans*), introduced with Europeans into Australia, breeds in manure, bites cattle and horses as well as man, and has been suggested as a carrier of infantile paralysis. An allied species, *Lyperosia exigua*, has been introduced into the Northern Territory, probably from the East Indies. This species, a close relative of the house-fly of Europe and America, is commonly known as the buffalo-fly, and appears to be rapidly extending southwards. It has already reached the Kimberley district in north-western Australia, and appears likely to extend into Queensland. Though it does not transmit any disease, the buffalo-fly causes severe damage by harassing cattle, and producing on them chronic sores with consequent loss of weight. E.W.F.

Bloodwood, vernacular name of several species of *Eucalyptus;* but the brush or scrub bloodwood is a *Baloghia* (q.v.).

Blowflies, vernacular name applied to insects of the genus *Calliphora* and its allies, which abound everywhere in Australia, from the hot inland plains to the highlands of the dividing ranges. Breeding in countless numbers in dead victims of drought seasons, or in skinned or poisoned rabbits, they have developed a taste for the hinder parts of living sheep. Heavily-woolled sheep and ewes are especially liable to attack, and their hinder parts may often be seen covered with eggs and young maggots, which quickly work their way to the skin. Soon boring this, they cause blood to flow; this attracts more flies; large scabs are formed and broken, and, as the sores become infected with disease, death frequently results. The maggots also not infrequently enter the body by the natural openings, and cause intense irritation, sometimes ending in death. The flies are more troublesome in wet, warm weather than at other times. As a rule a sheep once blown continues to be blown, and gives off an offensive smell that can be noticed at some distance. Many thousands of sheep are lost annually by the attacks of these flies, others are seriously reduced in condition, and the loss of wool—due to the sheep's rubbing itself to allay the irritation—is very considerable. Crutching, or removing the matted wool in the places most liable to attack, is often practised, but is a tedious and costly operation. Various deterrents (mostly with arsenic, sulphur, or carbolic as their main ingredient) are used, but, since the wool is continually growing, have only a temporary effect. In 1913 W. W. Froggatt, government entomologist of New South Wales, established the first experiment station, and has succeeded in ascertaining (*a*) that decaying animal matter, or at least vegetable matter tainted with animal matter, is essential to the breeding of the maggots, (*b*) that various parasites, of which the chalcid wasp (*Nasonia brevicornis*) is the most efficient and most easily bred, would destroy the blowflies in different stages of development. Since 1921 Froggatt has bred millions of these wasps for distribution over the State; and it is considered that in this way, and by systematically burning (or poisoning with arsenic) all carrion on the runs, the pest will be mastered and possibly exterminated.

In houses meat and even cooking-pots are rapidly fly-blown, especially by certain species which are viviparous, laying live maggots instead of eggs. In camp-life blankets are similarly affected if in the least moist through perspiration, and these need constant airing and attention. Fly-doors and window-screens greatly mitigate this nuisance in the house, while food-scraps and greasy water should be carefully covered or buried, not merely thrown on the soil or just covered with earth. The larvae generally burrow into the ground to pupate, but can usually mature otherwise.

The commonest species affecting sheep are *Anastellorhina augur*, *Neopollenia stygia*, and *Chrysomyia albiceps*. The first two are the species most frequently found in houses; but several of the bluebottle flies (*Lucilia* spp.) are also troublesome in the house and to sheep.

Blueberry. This name is popularly given to several species of *Elaeocarpus*, a genus of the family Elaeocarpaceae, consisting chiefly of trees or large shrubs, which has spread from Asia to Malaysia and even to New Zealand. Fourteen species are endemic in Australia. *E. reticulatus* (also known, but incorrectly, as *cyaneus*), which ranges from Tasmania to Queensland, is usually a small tree (rarely reaching a height of 50 feet), and bears a profusion of white bell-shaped flowers with fringed petals; the fruit, a bright-blue, succulent berry, is also highly ornamental. It has a tough, light-coloured wood which has been favourably compared with English ash. The fruit of *E. Bancrofti* is eaten by settlers on the Johnstone River in Queensland. Its timber resembles the American *lignum-vitae*. *E. grandis*, a moderate-sized tree extending from northern New South Wales into Queensland, has large, blue drupes known to children as blue figs, and sometimes, but incorrectly, as quandongs. The aborigines, who also eat the fruit, call the tree 'callangun.' It has a soft, easily-worked wood suitable for brakes on railway carriages.

Bluebottles, vernacular name for Coelenterata of the genus *Physalia*, called in other parts of the world 'Portuguese men-of-war.' They are free-swimming colonial forms, in which the individuals comprising the colony are modified in various ways according to the work they perform. Several species, which are notorious for their dangerous stinging properties, are found in Australian waters. The most prominent part of a *Physalia* is the large pear-shaped bladder containing air which serves as a float, lying horizontally on the water; it is pointed at both ends, and produced along its upper surface into a crest or sail. As a rule this is of a brilliant peacock-blue colour, but orange-coloured specimens are sometimes met with. From the lower surface of the float is suspended a mass of generative buds that look like bunches of grapes, as well as feeding polyps with long tentacles stiff with batteries of stinging cells. There are no organs of propulsion; the float, borne wholly above the surface of the

sea, is carried along by the breeze with the broad end foremost and the tentacles trailing behind. The length of the tentacles varies considerably, but specimens have been observed with tentacles over 50 feet long. Two species of *Physalia* regularly visit our coast. In recent years a third species has made its appearance on the coast of Queensland; it is quite distinct from *Physalia,* belongs to a different genus (*Caravella*), and is closely allied to a species which follows the track of the Gulf Stream.

Some time ago information was collected in Queensland on the effect of stinging by *Physalia.* All the cases investigated seemed to show very similar symptoms, resembling electric shock followed by intense pain, generally fainting and collapse, sometimes profuse sweats and cold skin. Headache, nausea, vomiting, and sometimes paralysis may ensue, with a convalescence of several days; in one case the pain lasted for three weeks. No fatal case in an adult has been reported, but three deaths among children seem well authenticated. Apparently the poison or shock, though insufficient to kill an adult, may kill a child up to 12 years of age. The injury looks like a burn, and the scars in some cases are said to have lasted for years. The best cure is to rub the skin vigorously with sand, both wet and dry; the latter is the quickest to act, but both are efficient in removing the pain. This is purely a mechanical cure. The sand probably destroys the stinging darts and minimizes the amount of poison injected. Applications of soda, ammonia, or Condy's fluid to the sting have proved useful as emergency measures. Recovery after treatment, and usually without it, is complete and permanent. Another form sometimes washed ashore on our ocean beaches after heavy weather is the By-the-wind Sailer (*Velella*). These animals, which are of a deep indigo colour, are often found in swarms sailing along in the breeze, especially in warm latitudes. In *Velella* a vertical ridge (the sail) is placed diagonally across the upper surface of an oblong disk; attached to the lower surface of the latter is a central feeding polyp, surrounded by smaller polyps, generative buds and a marginal fringe of tentacles. A small form, *Porpita,* consists of a disk-like body from which depend polyps and tentacles.

E.A.B.

Blue Crane. See HERONS, EGRETS, AND BITTERNS.

Bluefish, a brightly-coloured species (*Girella cyanea*), plentiful at Lord Howe Island, and occasionally captured on the coast near Sydney, where a headland (Bluefish Point) has been named after it. Though closely related to the common blackfish of New South Wales—which like various allied species is herbivorous—the bluefish is carnivorous, and readily takes a hook baited with fish or with a large white grub (the larva of a longicorn beetle) found in decaying wood. Corresponding with this diet, its flesh is superior to that of its weed-eating relatives, and half-grown examples ('pannies') are choice table-fishes. It attains a length of about two feet and is bright blue in colour when first hooked, with golden spots on the sides; it changes to a dull leaden colour a few minutes after capture. Semi-albino specimens are sometimes caught, which are uniformly yellow.

A.R.McC.

Blue Jay. See CUCKOO-SHRIKES AND CATERPILLAR-EATERS.

Blue Mountain Cypress. See CALLITRIS.

Blue Mountains, THE, a much dissected eastern spur of the main dividing range of New South Wales, which about 30 miles west of Sydney spreads into a north-south ridge visible from most elevated spots on the shores of Port Jackson. For the first 25 years of the colony's existence this ridge was an impassable barrier to any westward extension of settlement. Rising steeply from the western bank of the Nepean, flanked on the north by the even steeper ridge of the Kurrajong and on the south by a region of stony rises and tangled gorges that is not yet well settled, it seemed penetrable only through the cliff-sided valleys of the Grose and Warragamba; but explorer after explorer found these valleys more difficult than the hills above them. The Grose valley, indeed, and many of the branch valleys along the Warragamba-Cox, terminate in cliffs as sheer as those which border them. It was not until Gregory Blaxland (or William Lawson, q.v.) devised the plan of climbing the ridge itself, and keeping along its top instead of dropping into the valleys, that a road across it was found; then, the spur once traversed to Mount York, the Cox valley could be again entered and a passable track discovered over the real main range (which is in those parts no more than a vague watershed) to the western rivers. To this day only two routes lead west from Sydney —Blaxland's over the Blue Mountains, followed by road and rail, and Bell's Line over the Kurrajong and along the northern side of the Grose valley, which for many years has been a rough stock route but is capable of great improvement. The various pre-Blaxland attempts to cross the ridge are narrated under EXPLORATION BY LAND, and the making of the first road under COX, WILLIAM.

Geologically the Blue Mountains are the remains of a huge plateau of Hawkesbury sandstone that lies on a thin bed of chocolate shale; beneath the latter is a thick stratum of Narrabeen sandstone superimposed on Permo-Carboniferous coal-measures. A steep monoclinal fold in the strata accounts for the eastward slope of the plateau, which drops over 3000 feet between Mount Victoria and the Nepean valley. Its extreme dissection is due, first to the shale bed, which weathers rapidly, undercuts the Hawkesbury sandstone, and so produces the sheer cliffs that are characteristic of the area; and next to the underlying coal-measures, in which erosion is rapid and widespread. The huge blocks of sandstone that cumber the valley of the Grose—and made progress up that valley almost impossible to the early explorers—have fallen away from the upper cliffs. Behind the Kurrajong, north of the Grose, an important fault has let down the surface of the main plateau, and thus created a genuine two-sided ridge, whereas the Blue Mountains 'ridge' is merely the seaward face of a continuous slope.

The name 'Blue Mountains' is often used in a vague and erroneous way to denote the whole main range region west of Sydney; thus the Jenolan caves (q.v.) are said to lie 'in the heart of the Blue Mountains,' though they are at least 25 miles from their nearest edge. The name is properly applied only to the sandstone plateau bounded on the north by the Capertee and Colo rivers and on the south and west by the Cox; the Kurrajong ridge, though a part of this plateau, is usually considered a separate area. The name was originally given to the

hills west of Sydney because of the bluish haze that in a warm climate hangs over all hills seen from a distance.

It is to the existence of this 3000-ft. barrier just to the west that Sydney owes its most remarkable meteorological feature—the occasional raging westerly wind (hot in summer, bitterly cold in winter) followed within 24 hours by a southerly wind that comes up the coast and when violent is known as a 'southerly buster.' Across the inland plains the set of air is usually easterly; the Blue Mountains divert this into the upper regions of the atmosphere, and at that level it flows continuously above Sydney, north-easterly winds replacing it at the lower level. When disturbances farther north interrupt the north-easterly current, the west wind drops from the higher level to take its place; but the same lack of pressure that allows this drop also invites an inflow of cold air from the

The Blue Mountains

(valleys on left bank of Nepean shaded). ——— Cox's road - - - Bell's Line

south, so that the westerly summer wind (being hot) cannot blow for many hours. In winter, when both the westerly and the southerly winds are cold, they may fight out between them for some days the possession of the low-lying coastal area.

Blue Thistle. See ERYNGIUM.

Blue Wren. See WRENS.

Blyth, SIR ARTHUR (1823-1891), was born at Birmingham on 21 March 1823, educated at King Edward VI school there, and in 1839 brought by his parents to Adelaide, where he worked under his father as an ironmonger. Living near Mitcham, he became chairman of the district council and member for Yatala in the old legislative council (1855) and for Gumeracha in the new (1857); this seat he held until 1875, with an interval in 1867-9 when he was away in England. He took his share in the troubled politics of the colony, becoming commissioner of works in the Baker (1857) and Hanson (1858-60) ministries, treasurer in the Waterhouse ministries (1861-3), commissioner of crown lands in a ministry of his own (1864-5), treasurer in the Ayers ministry (1865), chief secretary in the Boucaut ministry (1866-7), commissioner of crown lands in the Hart ministry, and finally twice premier (1871-2, 1873-5). During all these years the land question was the most contentious issue, and Blyth's varied political career was mainly conditioned by attempts to harmonize the public good with the public's wishes in this regard. In 1875 James Boucaut (q.v.) put forward an ambitious programme of public works, and defeated Blyth (who now left Gumeracha for North Adelaide), but the next year took him into his ministry as treasurer: on Boucaut's defeat Blyth became agent-general for the colony, reached England in 1877, and resided there till his death on 7 December 1891. Apart from politics (in which he was rather of the permanent official than of the partisan type) Blyth had no special interests, though he was a captain in the volunteer corps raised in Adelaide during the Crimean war, a director of the South Australian Company, and a member of the university council. As agent-general he represented his colony in the colonial conference of 1887. (K.C.M.G., 1877; C.B., 1886.)

Boake, BARCROFT HENRY (1866-1892), son of an Irish father and an Australian mother, was born at Balmain (Sydney) on 26 March 1866, and trained as a surveyor. In July 1886 he became field-assistant to a surveyor in the Monaro district, but after two years preferred the life of a boundary rider and drover on the western plains of New South Wales and Queensland; in 1890, however, he reverted to survey work in the colder climate of the upper Murrumbidgee. At the end of 1891 he returned to

Sydney, but failed to secure work there, and on 2 May 1892 hanged himself at Middle Harbour with the lash of his stockwhip.

This premature close of a career that promised greater achievements was apparently due to the strain of inactive and unprofitable city life telling on a temperament naturally morbid and a weak, slow-beating heart; financial difficulties and the example of A. L. Gordon—whom Boake greatly admired—had their share in it also. Boake's posthumous volume of verse, *Where the Dead Men Lie*, obviously inspired by his recollections of Monaro and the Diamantina, shows promise but little more: and his reputation rests mainly on the one powerful but morbid poem that gives the volume its title.

Boatswain-bird. See TROPIC-BIRDS.

Boldrewood, ROLF. See BROWNE, T. A.

Bolly Gum. See LITSEA.

Bombax, a genus of the family Malvaceae, consisting of trees chiefly found in Central and South America, with one species from tropical Africa. The only species indigenous to Australia is *B. malabaricum*, found also in tropical Asia. Its large trunk and limbs are covered with short, conical prickles; flowers large, red, clustered towards the ends of the branches; leaves with 5-7 leaflets, falling at flowering-time; fruit a large capsule, densely woody inside. It is known in India as the Malabar silk-cotton tree. The young roots have astringent properties. The wood is used for packing-cases and for lining wells. In Burmah the trunk is often hollowed out for canoes. The silky cotton, though pretty, is not suitable for spinning, but is largely used in upholstery for stiffening cushions, etc. A kind of quilt or thick cloth is made from it in Assam.

Bonito, a widely distributed fish (*Euthynnus pelamis*) ranging over all warmer seas. It is an inhabitant of open ocean, rarely venturing into coastal inlets. Though at various times the bonito has been taken off the Australian coasts, and is known to occur in large schools, very little is recorded of its migrations and habits in our waters. The flesh is very red and oily, and is considered to be of so little value as food that the fish is rarely forwarded to the markets; but it is a fine game-fish, and its capture affords excellent sport to rod-fishermen using light tackle.

A.R.McC.

Bonnor, GEORGE JOHN, born in New South Wales on 25 February 1855, played cricket for both New South Wales and Victoria, and was a member of the second (1880) Australian team that visited England, as well as of the teams of 1882, 1884, 1886, and 1888; during the last two visits, however, he did not display his earlier form. He also played for Australia against Ivo Bligh's visiting team of 1883 and Shrewsbury's of 1884-5.

The effect produced in England by Bonnor's physique was remarkable. Ruskin described him as 'a young god,' and E. V. Lucas, writing in 1925, recalled to mind 'the mighty Bonnor, immensely tall, with golden hair and beard . . . this superb figure, like a god from another planet.' But his lasting fame was won by his great hitting powers. His height was 6 ft. 6 in., and he used a bat weighing about 2 lb. 7 oz. Three of his best-remembered feats are (*a*) breaking the clock on the pavilion at Melbourne with a hit from the centre of the ground, (*b*) at Portsmouth in 1882 hitting the wooden sight-screen behind the bowler so hard and so frequently that it was splintered, (*c*) hitting a catch to G. F. Grace at the Oval for which two runs were actually run before the ball descended. Nor was hard-hitting his only virtue; his fielding, especially in the outfield, was brilliant, for he was a fast runner and had an excellent return to the wicket. His batting average in test matches was only 17, but this includes the years of his decline; in 1882-3 his average was 31, and in 1884-5 39.6. See CRICKET.

Bonwick, JAMES (1817-1906), born in London on 8 July 1817 and trained for the teaching profession, after several appointments in English schools was chosen to conduct the model school at Hobart, arriving there on 10 October 1841. In 1843 he resigned and opened a school of his own; in 1849 he moved to Adelaide to open a school there, but joined the rush to the goldfields in 1852, soon lost heart, and in Melbourne failed to make a success of either journalism or land agency. In July 1856, however, he was made inspector of denominational schools in Victoria, and proved excellent at the work; when a coach accident put a stop to his bush travelling, he opened a school at St. Kilda and made a hobby of investigations into early Australian history. In 1856 he had published in Melbourne *The Discovery and Settlement of Port Phillip*, and pamphlets on minor historical subjects appeared later; but it was in 1870, with the publication in London of *The Last of the Tasmanians*, *Daily Life of the Tasmanians*, and *Curious Facts of Old Colonial Days*, that he came into notice as a historian. In 1882 he published what is possibly his best-known book, *The First Twenty Years of Australia*, following it in 1883 with *The Port Phillip Settlement*. In 1884 he visited England, where he resided for the rest of his life, with occasional visits to Australia. He now entered on the task of searching the records office in London for papers relating to Australia, and in 1886 sent out to Parkes, then premier of New South Wales, notes on some important despatches he had discovered. Parkes immediately authorized him to transcribe these and other papers, and in 1888 instructed him to continue his researches as an official of the colonial government, handing over the material thus obtained to G. B. Barton to be used in the making of his *History of New South Wales from the Records*. One volume of this history having appeared, the government decided that the actual records should be made as public as the history derived from them, and in 1893 the first volume of the *Historical Records of New South Wales* appeared. While this and the succeeding volumes were announced as under the editorship of Alexander Britton and F. M. Bladen—and justly so—the mass of the material comprised in them was gathered by Bonwick, and his name also should be remembered in this connection. After the advent of federation the New South Wales government considered that the publication of these records should be taken over by the Commonwealth; the work was therefore suspended, and Bonwick's appointment came to an end. He died at Norwood near London on 6 February 1906.

While his historical work has suffered the fate of all pioneer work of its kind, and has been either embodied in or superseded by later work, it still has value. Coming when it did, however, before the interest of Australians in their past history was properly awakened, it

may be considered invaluable; 'but for the active search made in London by Mr. James Bonwick' wrote Alexander Britton, 'the early records of New South Wales would have been little better than a blank.'

Bony Bream. The so-called Bony Bream (*Nematalosa erebi*) is a freshwater herring, plentiful in many streams in the eastern and central portions of the continent, and apparently extending westwards also. It is closely allied to an estuarine form, *N. come*, which occurs in tropical parts of Australia and in the Indo-Australian archipelago. Both are extremely bony, and of little value as food; they are sometimes called 'hairbacked herrings,' in allusion to a long slender ray that projects backwards from the dorsal fin. A.R.McC.

Bonython, Sir John Langdon, son of G. L. Bonython of the family of Bonython of Bonython and Carclew in Cornwall, was born in London on 15 October 1848, brought by his parents to South Australia while quite young, educated in Adelaide, and in 1864 attached to the literary staff of the Adelaide *Advertiser*. Devoting himself to his profession, he soon became sub-editor and then editor of the paper, and in 1879 joined the proprietary; since 1893 he has been sole proprietor. Always interested in education (he was knighted in 1898 for his services in this respect), he was from 1883 to 1901 chairman of the Adelaide school board, from 1895 to 1902 chairman of the government agricultural college, and has been since 1889 president of the school of mines and industries, which was practically his creation. He is also a member of the Adelaide university council and deputy-chairman of the State's advisory council of education. In 1901 he was elected a South Australian member of the first federal parliament, and re-elected to the second without opposition, but retired from active politics in 1906, and was subsequently made chairman of the Commonwealth literary fund. He was one of 14 trustees appointed by the Australian soldiers' repatriation act of 1916, and one of seven commissioners appointed under the similar act of 1917. (Kt. Bach., 1898; C.M.G., 1908; K.C.M.G., 1919.)

Boobook Owl. See Owls.

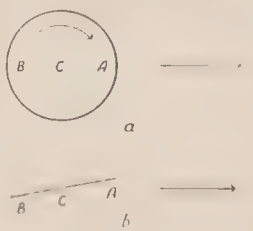
Booby. See Gannets.

Book-lice. See Psocoptera.

Boomerangs. The weapon most closely associated with the Australian aboriginal is the boomerang, of which there are various forms; some, large and heavy, are used for fighting at close quarters, others for fighting at a distance or for bringing down game, others again mainly for amusement. These (which are met with only in restricted areas) have the characteristic property of curving sharply in their flight and returning to a skilful thrower. In general shape all boomerangs markedly resemble the long, thin, curved leaf of many eucalypts; the blade is usually flat on one side and slightly convex on the other. In some cases one end of the weapon is shaped into a handle. The curve is usually a wide open one, but all grades are found between a scarcely noticeable curve and one in which the two ends are almost at right angles. The property of returning to the thrower (which is discussed below) appears to be associated with a very slight longitudinal twist. The plaything rotates during its passage through the air, and a really skilful thrower can make it describe first a large circle and then one or two smaller circles before it falls at his feet.

Starting from the ordinary throwing-stick, longitudinally straight but rounded in section, a series of weapons can be traced through a curved throwing-stick of circular section to one of elliptical section, then to a slightly flattened form, and so to the normal boomerang described above. From this type-weapon three lines branch—one to the highly specialized 'return' boomerang; a second to a form with one end slightly enlarged, and so to the beaked boomerang and the curved, club-like 'lil-lil;' a third through the handled form to the unwieldy 'sword' met with in Queensland. W.B.S.

The principles underlying the behaviour of a 'return' boomerang may be understood from a consideration of the flight of a disc projected edgeways-on while rotating about an axis perpendicular to its plane. Let (*a*) represent such a disc (the directions of rotation and translation being indicated by the arrows), and let the plane of the disc be vertical. Were it not for the rotation, the disc would quickly turn so that it travelled broadside-on; if it were deflected ever so slightly—as represented at (*b*), where BCA is the plan of the disc—it would experience resistance from the air which has to be pushed aside as it advances. The force due to air-resistance is greater on the front half (CA) than on the rear half (CB), because the air can slip past the latter more easily; so there is a tendency to turn the disc about a vertical axis until it assumes the broadside-on position. While rotating, the disc does not respond to these forces in the same way as when there is no rotation, because there is also a tendency to maintain the original rotation about a horizontal axis perpendicular to the line of flight. The effect of the forces tending to produce rotation about a vertical axis is gradually to change the direction of the axis of rotation from the horizontal towards the vertical; but the axis always remains perpendicular to the line of flight, or very nearly so, so that the plane of the disc is gradually twisted from the vertical towards the horizontal as it advances. Under the conditions represented in the figure the plane of the disc would twist over to the right as we look in the direction of its flight. Such a change of direction of the axis of rotation of a body—where forces are applied which, in the absence of rotation, would cause it to turn about a new axis—is called a 'precession;' it is well illustrated by the behaviour of a rolling hoop, which when deflected from the perpendicular does not fall to the ground, but changes its direction.



In addition to this precession of the axis of rotation towards the vertical, there is a second one (due also to air-resistance) which causes a change in direction in the horizontal plane. On account of the rotation, the velocity of the surface of the disc relative to the air in which it moves is greater in the upper than in the

lower half; so that in the upper part there is a greater tendency for the air to be pushed forward with the disc, and as a result the force due to air-resistance is greater on the upper half than on the lower. This inequality has the effect of checking the rotation, and also tends to cause a rotation about a horizontal axis parallel to the direction of flight; on account of the original rotation, however, what actually occurs is a precession, the axis of the disc turning slowly in a horizontal plane, and with it the direction of advance. In the example illustrated in the figure this second precession would make the disc and its direction of advance turn to the left as we look in the direction of the flight.

There are, therefore, two precessions due to air-resistance, one causing the plane of the disc to twist over to the right or left and the other causing it to turn to the left or right, the direction of advance changing with it. As the plane of the disc departs from the vertical, the path will bend upwards. As the motion continues, the relative importance of the two precessions will change; and this, together with the fact that the path will also change on account of gravity, renders the calculation of the complete path a problem of great complexity even with the simplest of bodies. However, if at any instant we know the direction of the plane and the directions of its rotation and translation, the directions of the two precessions can be determined as in the special case taken here. Experiments made with thin pieces of card, to which a translational and rotational motion are given by flicking them with the finger, illustrate the two precessional effects.

In the boomerang we have a body less simple in form than that considered, but the principles are the same. As a result of the rotation and translation there are two precessions, whose relative importance depends on (*a*) the design of the weapon and (*b*) the initial conditions impressed by the thrower. O.U.V.

Boothby, Benjamin (1803-1868), born at at Doncaster in Yorkshire on 5 February 1803, was called to the English bar in 1825, travelled the northern circuit, and became recorder of Pontefract. In 1853 he was appointed, by letters patent under the great seal of the province, a puisne judge of the supreme court of South Australia, but soon distinguished himself by repeated disagreements with the chief justice, Sir Charles Cooper, so that a third judge had to be appointed in 1858 to facilitate the administration of justice. When Sir Charles went to England on leave, Boothby became acting chief justice; but when Sir Charles resigned in 1861, R. D. Hanson, then attorney-general of the colony, was given the chief-justiceship. Boothby at once challenged this action on the ground that the nature of his own appointment gave him unqualified right to take the senior position, and objected (on the ground that it made no similar provision for other judges) to the South Australian act which gave Cooper a pension. In the end he declared that the constitution act of 1856 was invalid—as well as all laws enacted under its provisions—and postponed the trial of many prisoners arraigned before him on the ground that the soi-disant attorney-general had no legal existence, and therefore could not indict anybody. The whole judicial system was thus thrown out of gear, and the scandal grew so great that parliament petitioned for Boothby's removal from office. The Duke of Newcastle, then colonial secretary, refused to go so far, but secured the passage through the British parliament of acts validating the proceedings to which Boothby had objected. This made no difference to the recalcitrant judge; he maintained his position, and in 1866 a renewed appeal for his removal was made to Lord Carnarvon (Newcastle's successor), who suggested that the colonial authorities should themselves take action. In July 1867, therefore, the governor in council formally removed Boothby from the bench. His intended appeal to the privy council was frustrated by his death on 21 June 1868.

Boothby, William Robinson (1829-1903), son of Benjamin Boothby (q.v.), was born at Nottingham in England on 26 September 1829, and educated at the university of London; he migrated to South Australia with his father in 1853. In 1854 he was made deputy-sheriff and returning officer for the colony, and in this capacity conducted all the elections for 50 years after the establishment of responsible government; from 1856 onwards he was sheriff. Naturally interested in election methods, he prepared both the clauses of the act of 1856 that instituted voting by ballot (q.v.), and those of the act of 1858 that substituted for deletion of the names of unfavoured candidates the placing of a cross against the name of the favoured candidate. (This balloting method is used in all federal elections and referendum polls.) In later years he became comptroller of prison labour, and a senator of the university of Adelaide. He died in Adelaide on 12 July 1903. (C.M.G., 1893.)

A younger brother, Josiah Boothby, born at Nottingham on 8 April 1837, reached South Australia with the rest of the family in 1853, entered the public service during that year, was government statist from 1863 to 1879, and superintended the census in 1861 and 1871. (C.M.G., 1878.)

A nephew, Guy Newall Boothby (1867-1905), gained some fame as a popular novelist.

Boragineae, a large family of herbs (rarely shrubs or trees), the herbaceous genera chiefly found north of the equator, the shrubby species mostly in the tropics. Twelve genera, including 61 species, are indigenous to Australia. The flowers are usually small, frequently arranged in one-sided spikes; fruit a drupe, or dry, and separating into four distinct nuts. The genus *Ehretia* has five indigenous species. *E. acuminata* (Brown Cedar) is a moderate-sized tree with a light brown wood resembling that of the English elm. The genus *Heliotropium* has 23 indigenous species, mostly herbs or under-shrubs. *H. europaeum*, an inland (apparently indigenous) species which is also a common European plant, is developing into a weed in cultivated areas. The exotic *H. peruvianum* is the Heliotrope of our gardens. The genus *Myosotis* is represented by two indigenous species; *M. australis*, a diffuse herb with small white to yellowish flowers, ranges from Western Australia to New South Wales, and extends to New Zealand; *M. palustris* (exotic) is the Forget-me-not of Britain. See Cordia.

Bore-fish. See Spangled Grunter.

Boronia, a genus of the family Rutaceae, endemic in Australia. The calyx-lobes and petals are 4; stamens 8; the filaments thickened

towards the summit; fruit dry with 4 nearly distinct 2-valved carpels, each containing a solitary seed; leaves opposite, entire, or more or less divided into leaflets. *B. serrulata* (Native Rose), a strongly scented undershrub with pink flowers and rhomboid leaves with diminutive saw-like teeth round the margins, is one of the most highly-prized bush-plants in the Port Jackson district, to which it is confined. *B. pinnata* and *B. floribunda* (feathery-leaved species) and *B. ledifolia*, with simple leaves, are the common boronias of the sandstone hills. The variety *citriodora* of *B. pinnata* is the Lemon-plant of Tasmania, an alpine species with a strong lemon scent, which might well be used for the production of citronellol on a marketable scale. The Western Australian *B. megastigma*—flowers brown outside, yellow within—is extensively cultivated in the eastern States for its delicious fragrance. The flowers of this species have been suggested as a flavouring agent for tea, as they resemble in aroma those of *Chloranthus inconspicuus*, used in China for that purpose. In some parts of southern New South Wales

Boronia pinnata.

the leaves of *B. rhomboidea* are chopped up with fodder and given to horses as a vermifuge.

Bosanquet, Sir Day Hort (1843-1923), born at Rock Hall near Alnwick in Northumberland on 22 March, 1843, entered the royal navy in 1857 (lieutenant, 1863; commander, 1874; captain, 1882; rear-admiral, 1897; vice-admiral, 1902; admiral, 1905). He was commander-in-chief of the East Indies squadron (1899-1902) and the North American squadron (1904-7), and then for a year commanded the Portsmouth station. In 1909 he was made governor of South Australia, and held that position till 1914. While his work was mainly of the routine class, it brought him Swedish and Prussian decorations, as well as the British orders enumerated below. He died on 28 June 1923. (K.C.B., 1905; G.C.V.O., 1907; G.C.M.G., 1914.)

Bossiaea, a genus of the family Leguminosae, consisting of shrubs, endemic in Australia. They have cylindrical, flat, or winged stems; flowers orange to red; pods flattened. *B. foliosa*, an erect, graceful shrub, has small orbicular leaves, often only one line long, arranged in regular pairs along the slender branches. The small pods are clothed with a thick coat of silky, red hairs. *B. heterophylla* has compressed, winged branches and leaves with an extreme range of variation in shape and size. In *B. scolopendria* the flattened stems and branches (cladodes) are leafless; the stems perform the function of leaves, as in the phyllodes of *Acacia*.

Bossiaea lanceolata.

Botanic Gardens. Sydney.—Phillip on his way to New South Wales in 1787-8 collected at Rio de Janeiro and Cape Town a number of plants and seeds, and one of his first acts after arrival in Port Jackson was to set apart land for a farm and garden on the cove immediately east of the township, called by the aborigines Wockannagully but by Phillip renamed Farm Cove. The plants from Rio and the Cape, however, were first planted on the slope above the governor's tent—that is, between Phillip-street and Macquarie Place—which thus became the first Australian botanic garden. The farm proved a failure, its soil being barren and rust affecting the wheat; before Phillip left he handed over part of it to Nicholas Devine, a superintendent of convicts; when in 1794 Devine secured from Grose a larger block of land, Joseph Gerrald (one of the 'Scottish Martyrs,' q.v.) was allowed to occupy the Farm Cove garden, but died there after four months' residence on 16 March 1796. From that time on it seems to have been retained as government property, and Phillip's collection of plants was gradually transferred to it. In Bligh's time it was a 'shrubbery' laid out in walks and clumps of trees; Macquarie took through it his road to Mrs. Macquarie's Chair, and on 13 June 1816 formally dedicated it as a botanic garden and appointed Charles Fraser its first superintendent. The area thus dedicated is now known as the Middle Garden. In 1817 a large Norfolk Island pine, now known as the

'wishing tree,' was shifted from the Phillip-street garden to its present position. Fraser, who had been dignified with the title 'colonial botanist,' was not satisfied with the soil, and persuaded Macquarie to clear and fence 15 acres at Double Bay; but Brisbane cancelled this arrangement, added five acres to the Farm Cove site, and by 1825 had introduced nearly 3000 new specimens of food-plants and fruit-trees. The colonial office now began to take an interest in the garden, and demanded half-yearly reports including 'an accurate description of the Plants and Vegetables, which are peculiar to the Climate of New South Wales, as well as those, peculiar to other Countries, which are susceptible of cultivation to any useful purpose, if introduced into the Colony;' the botanist's salary, however, was left at seven shillings a day, and out of that he had to pay travelling expenses and the cost of sending seeds, etc., to England. This was no negligible expense, for in 1830 Fraser reported that he had sent seeds and plants to all parts of the world, including 1800 specimens to Glasgow for Professor Hooker.

Fraser died in 1831, and was succeeded by Richard Cunningham (q.v.), under whom the Lower Garden was laid out. When he was killed by blacks in 1835, his brother Allan (q.v.) took his place; during intervals between the death of one botanist and the arrival from England of another, John McLean (1831-3) and James Anderson (1835-7) looked after the garden. Allan Cunningham on appointment found that the establishment was still used for purposes unbefitting a botanic garden—e.g. he was asked to cultivate vegetables for the supply of high officials' tables—and lost little time in resigning his position; the circumstances are detailed in the article under his name. In 1837 a collection of plants was sent to Captain Lonsdale to stock the first government garden at Melbourne; almost at the same time another collection was sent to the newly-formed province of South Australia. Allan Cunningham was succeeded by James Anderson, who died on 24 April 1842; his successor, William Nasmyth Robertson, died in July 1844, James Kidd acted as temporary superintendent, and John Carne Bidwill (q.v.) was appointed on 1 September 1847, with the title of director and government botanist. Through some confusion, the home government also made an appointment, and Charles Moore arrived in Sydney on 14 January 1848 to take up the position, Bidwill receiving an appointment as commissioner of crown lands for the Wide Bay district. Feeling ran so high regarding the dual appointment that Stuart Donaldson, with the idea of starving Moore out, moved the reduction of the annual vote to £150; in this he failed, as well as in his later endeavour to have the gardens cut up and sold in allotments. Moore, who remained in office for nearly half a century, remodelled the greater part of the gardens, and under his supervision in 1869-70 the harbour frontage was reclaimed and the semi-circular stone wall erected. Superannuated in 1896, he was succeeded by J. H. Maiden, who resigned in 1924. The present curator is Dr. Darnell Smith.

The gardens now occupy an area of about 190 acres; the national herbarium (adjoining the curator's residence) erected under Moore, and greatly enlarged under Maiden, contains a large collection of botanical specimens and a fine botanical library. From a nursery attached to the gardens 153,000 plants and trees were distributed to State schools and public bodies during 1924.

BRISBANE.—In 1828 Charles Fraser, colonial botanist of New South Wales, was directed by Governor Darling to visit Moreton Bay and 'establish a public Garden at Brisbane Town.' Accompanied by Allan Cunningham, he arrived at Brisbane on 1 July 1828, and on the 3rd determined the boundaries of a garden containing 42 acres on the north bank of the river. James Backhouse in 1836 describes this garden as '22 acres of Government-garden for the growth of sweet potatoes, pumpkins, cabbages and other vegetables for the prisoners.' Up to 1855 the area was under military control, but in that year Walter Hill was made director of the botanic gardens with R. R. Mackenzie (q.v.) as chairman of the controlling committee. Hill was an ardent collector of the indigenous flora, as well as being keenly interested in exotic tropical and subtropical vegetation; he therefore made the gardens of unique interest by successfully filling them with flowering trees and shrubs, including many collected from the rich Queensland scrubs. In the early seventies an attempt was made to destroy his work by extending the business part of the city across the garden area, but this vandalism was fortunately averted. When Hill retired in 1881, F. M. Bailey (q.v.) was appointed colonial botanist and James Pink head gardener; Pink retired in 1886 and A. M. Cowan took charge until 1889, when P. McMahon was appointed curator. The great flood of 1893 swept across the peninsula on which the gardens are situated, damaged the bunya avenue and all the lower part of the grounds, and stranded a gunboat and a coasting steamer in the middle of the gardens. A second flood, 14 days later, carried the vessels back to the river. In 1905 J. F. Bailey became director, and in 1915 succeeded his father as government botanist; but in 1917, when he took the directorship of the Adelaide botanic garden, his nephew C. T. White was appointed government botanist, and E. W. Bick curator of the Brisbane gardens. The gardens now have an area of approximately 50 acres, a portion of the former government house domain having been added to them in 1916.

MELBOURNE.—Gipps having approved the establishment of a 'public domain for the purpose of rearing and cultivating indigenous and exotic plants,' Lonsdale in 1841 ordered Robert Hoddle, then surveyor-in-charge, to mark off a block of 50 acres on Batman's Hill and the adjoining river-bank. Of this order, as of many given by Lonsdale, nothing came; but several other sites were suggested, and in 1845 Latrobe chose the slopes of a gully leading down to the Yarra near the grounds of government house. Here John Arthur, the first superintendent (who was given that post on 1 March 1846), fenced in a 5-acre paddock and laid it out in flower-beds and plantations. Both he (1846-9) and John Dallachy (1849-57) paid attention to the introduction of exotic plants, and allowed the gardens to be used for horticultural shows. In 1857 a new office was created; Dr. Ferdinand Mueller (q.v.) was made director of the gardens, and at once began to develop their resources and their usefulness. He established close relations with similar scientific institutions all over the world, effected important exchanges of plants, re-arranged and much extended the grounds, and paid particular attention to the native vegetation. He also devoted part of the area to beds showing a scientific arrangement

of plants in their natural orders, etc., and established a 'national herbarium' which has become the most complete extant collection of Australian dried plants. In 1873 he retired in order to devote himself entirely to his work as government botanist, the directorship was abolished, and William Robert Guilfoyle became curator. He during his term (1873-1909) extended the gardens by over 30 acres and increased the number of species represented from 2500 to 14,000. The deepening and straightening of the course of the Yarra allowed an extension of the garden area which took in the old river-channel and added it to the existing lake, making 83 acres of garden and 10 acres of lake. A very complete re-arrangement followed, which has made the gardens probably the best example of landscape gardening in Australia. They now include a museum of botany (containing the herbarium), a 'classification pavilion' in which plants are arranged on Bentham and Hooker's system, and an 'Australian Plantation' of indigenous trees and shrubs. On Guilfoyle's retirement in December 1909 John Cronin became curator.

HOBART.—On 14 October 1843 a meeting held at government house under the presidency of Eardley-Wilmot formed itself into the Horticultural and Botanical Society of Van Diemen's Land. It was the governor's reply to the recalcitrance of the older Tasmanian Society (see ROYAL SOCIETIES) which he had wished to broaden. To his new creation—which in 1844 became the Royal Society of Van Diemen's Land for Horticulture, Botany, and the Advancement of Science—he entrusted the larger part of government house grounds, with a grant of £400 per annum for their maintenance and a good supply of convict labour. The first superintendent, F. W. Newman (1845-59), established a system of exchanges with other Australian gardens and gave much attention to the breeding of wheats suitable for the Tasmanian climate. The second, Francis Abbott (1859-1903), greatly enlarged the grounds, and extended the system of exchanges to gardens all over the world. During his term, in 1885, the gardens and the Tasmanian museum (see MUSEUMS) were placed under a board of trustees and given an income of £800 a year (increased at a later date to £1300), which they were at liberty to supplement by the sale of plants and flowers. At Abbott's death in November 1903 Alexander Morton, then curator of the museum, was made director of the museum and gardens (1904-8), and was succeeded by Robert Hall (1909-11). On Hall's retirement in July 1911 John Wardman was appointed superintendent.

ADELAIDE.—In 1855 a botanic garden committee was formed, a site containing about 40 acres was selected on the south bank of the Torrens, and George Francis, F.L.S., was appointed superintendent. The garden was thrown open to the public in 1857, and the first catalogue of plants published in 1859. In 1860, at the suggestion of Dr. Ferdinand Mueller, a valuable collection of Kangaroo Island plants was made for the garden by F. G. Waterhouse. In 1865 Francis retired, and was succeeded (as director) by Richard Schomburgk (q.v.), during whose term the garden was enlarged and its usefulness to the State much increased. The cultivation of trees suitable for railway construction and other public purposes was begun on a large scale in 1871, a museum of economic botany was built and furnished with a herbarium, and the importation, acclimatization, and distribution of useful exotic plants was developed with excellent results. After Schomburgk's death in 1890 Maurice William Holtze, F.L.S., Ph.D., who had since 1873 been curator of the garden at Port Darwin, took over the directorship. He retired in 1917, and was succeeded by John Frederick Bailey, son of Frederick Manson Bailey (q.v.). The present botanic garden (including an adjoining botanic park under the same management) comprises an area of about 105 acres, controlled by a board of governors appointed by the State government. It includes a 'class ground' on which plants are arranged in their natural orders, and a house specially built for the *Victoria regia* water-lily (discovered in Guiana by Schomburgk's brother). At Mylor near Adelaide is a 'type orchard' containing specimens of practically all the fruit-trees adaptable to the local climate.

PERTH.—Perth has no botanical gardens in the strict sense of the term. Stirling Square, adjoining the government house domain, was set aside in 1829 for the purpose, and some endeavour was made by James Drummond (q.v.), the first government botanist, to bring it into order. It has, however, become rather a small park than a botanic garden, though some of the plants contained in it have been named. In King's Park a large area is retained in its natural state for the purpose of exhibiting the native flora. Since James Drummond's time there has been no government botanist charged with the management of the government gardens. Baron von Mueller acted as consulting botanist to the colony until his death in 1890, and Drs. Morrison and Cleland afterwards occupied a similar position—but their real work was that of botanists and vegetable pathologists to the department of agriculture.

Botany. In the *Flora Australiensis* of Bentham and Mueller (1863-78) 7837 species were described. In 1889 von Mueller, in his *Systematic Census of Australian Plants*, gave the number of vascular species as 8909, comprised in 149 families and 1394 genera. From this total must be deducted 92 species peculiar to Lord Howe and Norfolk Islands, so that the true total of known Australian plants at that date was 8817; as the author of this article has record of 1856 additional species since the date of von Mueller's second *Census*, it is undoubtedly an understatement to put the number of Australian phanerogams and vascular cryptogams at 10,673. The following estimate of described species in each State has been compiled from the work of the various government botanists:—Queensland, 4480; Western Australia, 3900; New South Wales, 3600; Northern Territory, 2050; Victoria, 2000; South Australia, 1985; and Tasmania, 1210. Von Mueller stated that of his total of 8909 species 7501 are endemic, and of the remainder (1338, or 15.1 per cent) there are found in Europe 160, Asia 1032, Africa 515, America 315, New Zealand 291, and Polynesia 558; these figures have not been brought up to date.

Approximately speaking, the 12 largest families of Australian plants are as follows:—Leguminosae (1276 species), Myrtaceae (816), Proteaceae (667), Compositae (635), Orchidaceae (439), Gramineae (433), Cyperaceae (421), Epacridaceae (301), Goodeniaceae (294), Filices (255), Euphorbiaceae (251), Rutaceae (232). The largest genera, with their approximate number of species, are as follows:—*Acacia* (412), *Euca-*

lyptus (230), *Grevillea* (193), *Styphelia* (193), *Eriostemon* (193), *Melaleuca* (112), *Candollea* or *Stylidium* (112), *Goodenia* (112), *Hakea* (107), *Hibbertia* (104), *Pultenaea* (93), *Eremophila* (91), *Schoenus* (77), *Pimelia* (76), *Ptilotus* (76), *Panicum* (75), *Boronia* (72), *Cyperus* (72), *Aster* (71), *Helichrysum* (70), *Scaevola* (68), *Baeckea* (66), *Daviesia* (64), *Cryptandra* (63), *Drosera* (62), *Persoonia* (62), *Ficus* (62).

Three types of country influence the vegetation —(*a*) the forest, (*b*) the bush, whether scrub or brush, (*c*) the so-called 'desert' lands. The term 'scrub' is in Queensland applied to (*b*); in New South Wales it is applied rather to the comparatively sparse vegetation of the more sterile sandstone and granite areas; but it is also used to denote open forest, in which the species are as a rule more gregarious than those of the 'brush.'

Brush corresponds to the Indian jungle, and is applied to areas of sheltered, well-watered rich soil (chiefly in the coast-belt and tablelands of eastern Australia) which support rich arboreal vegetation, creepers and climbers of various kinds and shrubby undergrowth; the tree-vegetation is most varied in character (e.g. Meliaceae, Sapindaceae, Saxifragaceae, Cunoniaceae, Lauraceae, Monimiaceae, Coniferae and Taxaceae), but rarely includes eucalypts. In brush forests the buttress-stem—often of considerable size—is of frequent occurrence. These buttresses are thin, nearly vertical, almost like stalls in a stable. They are common in figs, the yellow carabeen (*Sloanea*), booyong (*Tarrietia*), red cedar, shebeech (*Cryptocarya*), marara (*Weinmannia*) and many others. Extending sometimes in fantastic shapes along the ground or—as in the yellow carabeen—so delicate as to be only an inch thick where they enter the ground, they form natural struts, essential to the stability of the long trunks that run up towards the light. Lianes are not unusual in the brushes—generally the stems of *Vitis* (q.v.) from which drinking water can be obtained.

Much of the country marked as 'desert' in the old maps is not desert in the strict sense, since it sustains a more or less sparse vegetation, including trees, while immediately after rain innumerable plants carpet the country-side with many-coloured species of *Helipterum* and *Helichrysum*, pink and purple *Ptilotus*, or various species of Salsolaceae and Goodeniaceae. The riverless areas of central Australia support an interesting xerophytic vegetation, and strips throughout the so-called desert are really pastoral country, supporting both grass and edible shrubs (see GRASSES and FODDER-PLANTS), while year by year the wheat-line advances into this region. The permanent plants of the drier lands depend upon subterranean water, often of small quantity and of local occurrence, besides the vast artesian accumulations. In Western Australia local supplies known as 'soaks' form oases round which there is a specially interesting vegetation.

The vegetation over vast areas of Australia knows only two seasons, the dry and the rainy. The rainy season may last only a few days in the year, or may be (more usually) intercalated with dry periods. After these showers the surface of the ground is changed, as if by magic; young plants cover it over large areas with bright carpets, quickly mature, develop seeds—and disappear, until the wet period of their life-cycle arrives with further rain.

The adaptation to environment of Australian desert plants, particularly those of Western Australia, has been ably treated by S. le M. Moore. Henslow quotes Volkens as stating that certain xerophilous plants, which are covered with a resinous substance that prevents a too energetic transpiration, are peculiar to the southern hemisphere. Examples of this are *Beyeria viscosa*, *Eucryphia Billardieri* (the Pinkwood of Tasmania), various species of *Dodonaea* and *Acacia*; moreover the roots of various grasses, and the young shoots of *Angophora* and of the Corymbosae section of eucalypts are protected by a covering that contains caoutchouc. The blanket-plants (*Lachnostachys*) of Western Australia are especially woolly, as are the allied genera *Newcastlia* and *Dicrastylis*. Many composites and malvaceous plants are very hirsute, these non-conducting coverings tending to hinder transpiration.

Instances of aphylly (plants without true leaves) are numerous: e.g. native cherry (*Exocarpus*), cypress pine (*Callitris*), she-oak (*Casuarina*), *Apophyllum anomalum*, *Tetratheca juncea*, *Comesperma* spp., *Daviesia alata*, *Sphaerolobium vimineum*, *Viminaria denudata*, *Amperoea spartioides*, and many others. There are also many succulent plants among the Zygophyllaceae, Portulaceae, Ficoideae, Crassulaceae, Salsolaceae, Euphorbiaceae and Asclepiadaceae. Some plants have water-storing cells in stems, or in roots, or in both; notable examples are the kurrajong, and the bottle-tree, which ludicrously resembles a gigantic lemonade bottle. In the north-west the Gouty Stem (*Adansonia Gregorii*) is a feature of the landscape, while aborigines in dry country obtain drinking-water from the roots of certain mallees (dwarf eucalypts), particularly *E. incrassata*, *E. dumosa* and *E. oleosa* as well as from *Hakea leucoptera* and *Casuarina Decaisneana*.

Origin of the Australian Flora.—Regarding the original Australian element, Wallace in *Island Life* observes that south-western Australia is the remnant of a more extensive and more isolated portion of the continent in which the peculiar Australian flora was principally developed. 'The existence there' he says, 'of a very large area of granite—800 miles in length by nearly 500 in maximum width, with detached masses 200 miles to the north and 500 miles to the east—indicates such an extension; for these granitic masses were certainly once buried under piles of stratified rock, since denuded, and then formed the nucleus of the old Western Australian continent . . . . While this rich and peculiar flora was in progress of formation, the eastern portion of the continent must either have been widely separated from the western or had perhaps not yet risen from the ocean.' In Cretaceous times, and far into the Tertiary, there was no Australian continent in existence; in its place were a large, almost wholly ex-tropical western island, a long and narrow eastern island extending from Cape York to a point south of Tasmania, and between them a wide crescentic sea with smaller islands representing parts of the Northern Territory and western Queensland (see map in *Island Life*). In the Cretaceous period, as shown by Jensen (*Proceedings* of the Royal Society of Queensland) in an article based on David's maps, the sea extended over most of Queensland from Cape York southwards (the eastern ranges and coast excepted) and covered a considerable portion of northern South Australia and north-western New South Wales. Jensen remarks that the Cretaceous sea was probably connected at both ends with the ocean, forming the aqueous barrier postulated by Wallace. The disappearance of this Cretaceous

sea made possible an eastward migration of the hardy plants (*Eucalyptus*, Proteaceae, etc.), which had developed on the barren soils of Western Australia; encountering on the eastern land area an Indo-Malaysian type of flora, they either expelled or subdued it. Jensen submits evidence from the fossil leaves of the older 'deep leads' and the trachytic tuffs of the Warrumbungle Range to show that the plants thus expelled were largely Lauraceae.

Tate in 1888 divided the Australian endemic flora into three types—(1) Euronotian, occupying the NE. and SE. coastal areas, its internal boundary coinciding with the rainfall limits of 25-50 inches per annum—the typical flora of this section is dominant in the southern and eastern parts of the continent; (2) Autochthonian, restricted to the SW. corner of the continent, its internal boundary coinciding with the same rainfall limit in this part; (3) Eremian, occupying a large stretch of country that extends from Lake Eyre right across the continent to the shores of Western Australia, and over which the average rainfall is above 10 inches per annum. Besides this endemic flora there is what he styles an 'immigrant' flora with two constituents:—(*a*) Oriental, dominant in the littoral tracts, but mixed there with typical Australian genera; (*b*) Andean, restricted for the most part to the highlands of New South Wales, Victoria and Tasmania; with this he includes species characteristic of north temperate regions. Hedley and Baldwin Spencer have—on zoological grounds—suggested modifications of Tate's proposals; but the point of most importance is the demonstration of the fact that for a long period of time the eastern and western parts of the continent were separated by an impassable barrier of some description; and most authors agree that the separation took place in Cretaceous times. According to Tate the Eremian flora was developed in central Australia in Pliocene times from Autochthonian and Euronotian elements, and was largely modified by Oriental immigrants.

It was for some time held that the European Tertiary flora contained *Alnus, Betula, Quercus, Sequoia, Acer, Pinus* and other genera peculiar to the northern hemisphere, together with *Casuarina, Grevillea, Banksia, Dryandra, Leptomeria, Eucalyptus* and other genera peculiar to the southern hemisphere. Von Ettingshausen recorded *Eucalyptus* and *Metrosideros* in the Eocene beds of Sheppey, England; *Pimelia, Leptomeria* and four genera of Proteaceae were recorded by Heer in the Miocene of Switzerland. Ettingshausen believed he had found 55 Australian forms in the Eocene beds of Haering in Bohemia; but Hooker considered these determinations worthless, and Bentham disapproved of similar identifications by Heer and Unger. Ettingshausen also records many European forms in the Tertiary of Australia; but Deane (*Proceedings* of the Linnean Society of New South Wales for 1897) firmly disputes the accuracy of certain of the determinations, and Hemsley in the *Challenger* reports says that, until more conclusive testimony is forthcoming of the former existence of Proteaceae, *Eucalyptus*, etc., in Europe, we cannot avoid the conviction that they originated in the south.

Botanical determinations and deductions built by some palaeo-botanists upon mere leaf-impressions are to be regretted. Except in the case of very characteristic material, botanists who deal with existing flora usually ask to be excused from determining a plant on a leaf only. Bentham states that the predominant portion of our vegetation appears to be strictly indigenous, and that the great mass of purely Australian species and endemic genera must have originated, or have been differentiated, in Australia, and never spread far out of it. The only exceptions observed by him are (*a*) a few Australian types (e.g. *Eucalyptus*, Epacridaceae, phyllodineous acacias, etc.) which appear in Malaysia (especially in Timor, New Guinea, and Borneo) where they have established distinct, though in most cases, nearly representative species, sometimes, however, preserving absolute identity; and (*b*) a very few, chiefly annual or herbaceous, plants of various Australian genera which are found as far away as southern China, mostly in identical or very closely representative species. In Bentham's time, however, comparatively little was known of the Chinese flora; through the publication of Forbes and Hemsley's *Enumeration* and other works, we are now in a far better position to indicate the precise relationships of the Australian and Chinese floras. The flora of Malaysia is also now much more available to students.

According to Bentham, the principal flora that shows an ancient connection between Australia and other countries is the Indo-Australian. A number of genera whose main station is in tropical Asia extend more or less into tropical or eastern subtropical Australia, sometimes in identical, sometimes in more or less differentiated species. Those of coastal Queensland have generally an East Asiatic character. A few types belonging to Ceylon and India are more especially represented in Arnhem's Land, but scarcely any Indian forms are found westward of that peninsula. In his *Malay Archipelago* Wallace remarks that, when we consider the wonderful dissimilarity of the Papuan and Australian regions in all those physical conditions which were once supposed to determine the forms of life—Australia with its open plains, stony deserts, dried-up rivers and changeable temperate climate; Papua, with its luxuriant forests, uniformly hot, moist and evergreen—this great similarity in their productions is almost astounding, and unmistakably points to a common origin. He does not, however, note the fact that northern Queensland, east of the divide, may be described in terms precisely similar to those employed by him in regard to Papua.

The Austro-Malay element is common in the coastal brushes of Queensland and northern New South Wales. In 1892 above 2000 species of phanerogams were known from New Guinea; in 1911 nearly 3000 species had been described from that region, chiefly through botanical activity in the German possessions. The whole of New Guinea is a region of tropical forests, only occasionally interrupted by savannahs (grass-lands interspersed with trees). What Wallace says of Borneo—that an orang-utan could cross the island from tree to tree without putting his foot to the ground—applies fairly well to New Guinea. The chief savannahs are at the mouth of the Fly River, and the grasses there are chiefly composed of *Imperata arundinacea* (blady grass), *Themeda* (kangaroo grass), *Rottboellia, Andropogon, Apluda, Pennisetum*, etc., all tall grasses; while the interspersed trees are mainly specimens of *Eucalyptus* (*E. tereticornis, E. alba, E. clavigera, E. terminalis*) and other Myrtaceae, *Acacia* (*A. Simsii, A. holosericea* and another), and Proteaceae. The character of these Fly River savannahs is almost (or quite) identical with that of Cape York Peninsula, the northernmost point of which is only about 100 miles from the mouth of the Fly River; but this is the only part of New Guinea in which strong affinities

to the flora of Australia are shown. It seems strange that the Australian flora has not taken a greater possession of New Guinea; the types of its flora are South Asiatic, and Australian plants are rare there except in the Fly River savannahs. The data, however, are incomplete, and this statement cannot be made without reservation.

By far the majority of Papuan genera are Malaysian; but it would be wrong to consider the flora of New Guinea identical with that of Malaysia, the number of endemic genera and species being too great. Epiphytic rhododendrons are common in high elevations in what used to be German New Guinea, connecting the flora with that of the Himalaya. A rhododendron is also found on the Bellenden-Ker ranges in northern Queensland. Warburg states that rhododendrons —mostly beautifully large-flowered species—are common on the Papuan mountain ranges at high elevations, and that two indigenous Coniferae (*Phyllocladus hypophylla* and *Libocedrus papuana*) are closely allied to species he met with in mountain regions of Borneo. These genera are also found in New Zealand, and *Phyllocladus* occurs in Tasmania. Several species of *Quercus* (oak) are found at high altitudes in New Guinea, providing another link with the Himalaya. No *Quercus* has yet been found in Australia. As far as we know the floras of New Guinea, New Zealand and the Melanesian islands, endemism is greatest in the first-named region, but New Caledonia may be found to equal it when that flora is better known.

Agapetes and *Dracophyllum* also occur on the Bellenden-Ker range; the former genus is represented by about 30 species, chiefly from the southern Himalaya and a small number from Fiji, Borneo, and New Guinea; the two Papuan species have been found on the Owen Stanley range. *Dracophyllum* is interesting as connecting the Bellenden-Ker flora with the Antarctic, the genus is common in the Antarctic islands and in Tasmania, while one species is found in New South Wales, Lord Howe Island, New Zealand and New Caledonia, chiefly in mountainous regions. It is not found, so far as the writer knows, in New Guinea, Malaysia, or Asia. Bentham remarks that an exchange, limited in extent, has evidently taken place between north-east Australia and New Caledonia and other islands of the South Pacific is plants not strictly maritime. More Australian types appear to be represented in New Caledonia than New Caledonian types in Australia. Hooker, following Forster, used the expression 'Antarctic plants of Australia,' not because they inhabit land beyond the polar circle, but because botanically, in relation to the south temperate flora, they represent the arctic flora. He adds that they might almost be called alpine plants, for many found at sea-level in the so-called Antarctic islands also ascend the mountains of more genial latitudes. Bentham also notes the connection of the alpine flora of Tasmania, Victoria and New South Wales with the general southern extra-tropical and mountain region that extends through New Zealand to the southern end of the American continent, and thence up to the Andes. Many Australian species of this type are identical with, or closely representative of New Zealand species, and some have a much wider range. It is probably through this connection that a few species belonging to the temperate floras of the northern hemisphere have evidently, in very remote times, become represented in Australia. The tabular view of the distribution of the phanerogams of the islands south of New Zealand given by T. F. Cheeseman in *Sub-antarctic Islands of New Zealand*, together with his notes on the affinities of the flora, are most suggestive; see also valuable botanical contributions by Dr. L. Cockayne, R. M. Laing and D. Petrie in the same work. These antarctic representatives are chiefly to be found in Tasmania, which, moreover, has a surprising number of plants in common with the Australian Alps of Victoria and New South Wales. The antarctic genera represented in northern New South Wales (e.g. *Nothofagus*) and Queensland (e.g. *Dracophyllum*) are much fewer, as are also those of Kangaroo Island and South Australia.

The flora of South Africa and Australia have a great many species in common, but hardly any that are confined to the two regions; all, or nearly all, the species found both in South Africa and in Australia are cosmopolitan plants, or plants of wide geographical distribution. Even the genera common to the two countries are not numerous. Still, there are many affinities between them; but the connection that once probably existed, via the Antarctic, must have been broken so long ago that their common ancestors had time to develop into distinct species and genera. Australia, for instance, has 34 genera of Proteaceae, mostly endemic, though some are also found in New Zealand, New Caledonia and Malaysia; South Africa has 11 genera of this family, mostly endemic; and not a single genus of Proteaceae is common to Australia and South Africa. Yet, as Hooker points out, by far the greater number of the known species of Proteaceae are confined to these two countries. Of our Australian Restiaceae, the genera *Restio*, *Leptocarpus* and *Hypolaena* are common to both.

The enormous time that must have elapsed since the separation of the two floras by geologic changes is still better indicated by the Epacridaceae (q.v.) and Ericaceae. The common ancestors of the two families probably lived in both continents. As in the Proteaceae, the descendants developed along different lines; for some reason genera with anthers opening in terminal pores (Ericaceae) prevailed in South Africa, and genera with anthers opening in parallel slits (Epacridaceae) prevailed in Australia.

With regard to the Compositae Bentham says that, setting aside the cosmopolitan genera *Senecio* and *Gnaphalium*, the following genera are common to the two regions:—

	NO. OF SPECIES.	
	Australian	South African.
Brachycome	41	1
Helipterum	53	12
Helichrysum	70	137
Cassinia	13	1
Athrixia	7	6
Cotula	8	22

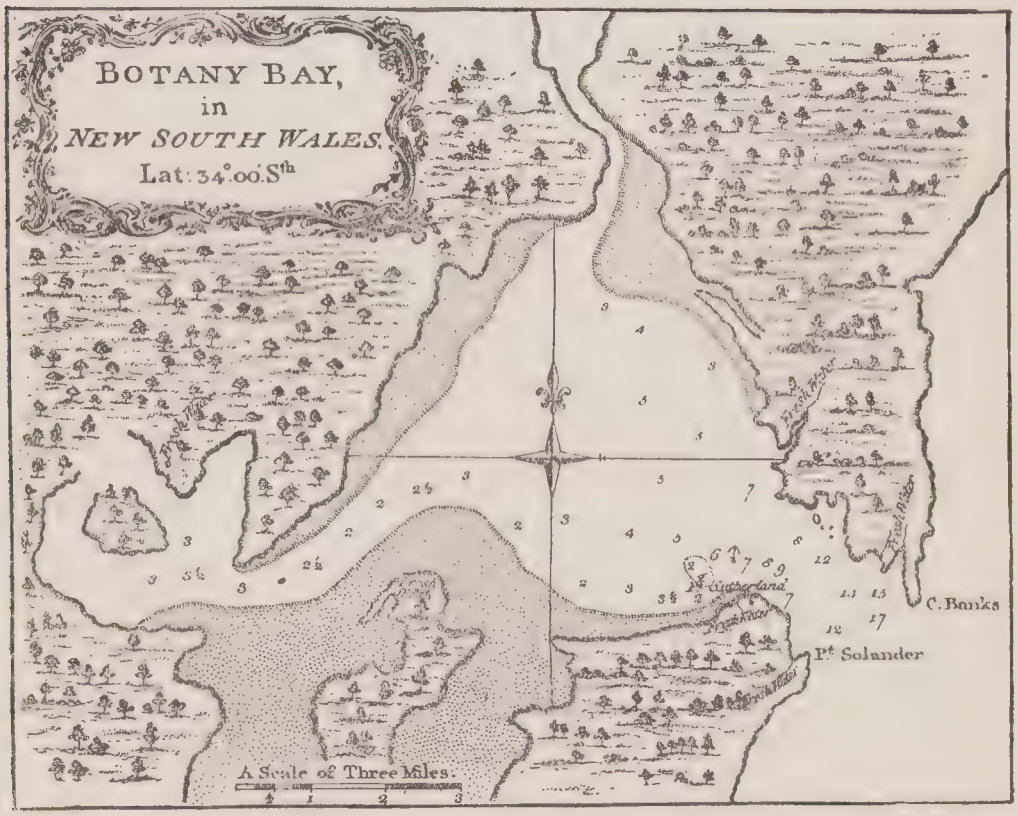
Bolus and Woolley-Dod point out that the three families Thymelaceae, Haemodoraceae, and Droseraceae are most abundant in Australia and, in the second place, in South Africa. Another point of likeness is seen in the remarkable deficiency in both countries of the otherwise widely diffused families Rubiaceae, Lauraceae, Araceae. Hooker, who first discussed the subject, suggested that the flora of Australia and south-western Africa might have had a common origin from ancestors inhabiting a vast Antarctic continent, of which the greater part has been submerged. He thought western Australia was connected with the Cape region by land at a time when it was severed from eastern Australia. But Moseley asks pertinently why marsupials are not found at the Cape, although they do occur in the Great Oolite of England. It would almost

seem that they must have occurred at the Cape, and have died out—unless Proteaceae and Restiaceae are very much older than marsupials, in which case they would be very old indeed.

Australia has three grand types of flora—the brilliant inflorescences of the sandy plains of Western Australia, the luxuriant vegetation of eastern Australia, and the alpine flora of Tasmania. South Australia, the north-west of Victoria and the vast western plains of New South Wales and Queensland approximate to the botanical conditions of the western State. Many Tasmanian or allied plants extend to south-eastern Australia generally. The rain-forests of western Tasmania are unique, and on the mainland are most closely approached by those of the Cape Otway district of Victoria. Bentham remarks that maritime plants, ranging at least from the Mascarene Islands to those of the Pacific, are also to be found on the Australian coasts, mostly in identical species, with the addition of a few representative species. The following families are entirely or almost entirely confined to Australia —Tremandreae, Stackhousiaceae, Candolleaceae, Goodeniaceae, Casuarinaceae, Philydraceae, together with the phyllodineous acacias (which form an enormous majority of the genus) and *Eucalyptus*.

It is sometimes stated that the Australian flora is of a primitive character, but Moore strongly asserts that this is the result of bias imparted by the zoological data. 'In what respect, it may be asked, is the flora of Australia less highly specialized? Are not most of the great natural orders strong constituents of it? Trees, some of them of gigantic size, shrubs, undershrubs and herbs, parasites and saprophytes, climbing and carnivorous species, flowers adapted to profit by the visits of insects, and sometimes provided with a complex mechanism to insure such profit—all these are met with in Australia. In addition, the adaptability to the dry climate is wonderful, and in this respect, taking into account the variety of ways in which the destructive effects of a scorching sun and parched soil are guarded against, the Australian flora is without a parallel the world over. And if these be not evidences of high specialization, it is difficult to know where one must look for such.'

The work of the principal botanists who have paid special attention to the Australian flora is discussed under their names. See BENNETT, GEORGE; BIDWILL, J. C.; BROWN, ROBERT; CALEY, GEORGE; CUNNINGHAM, ALLAN; CUNNINGHAM, RICHARD; DRUMMOND, JAMES; GUNN, R. C.; MACGILLIVRAY, J.; MUELLER, FERDINAND VON; SOLANDER, D. C.; WOODS, J. E. T.; WOOLLS, WILLIAM. The work of W. S. Macleay is noticed under MACLEAY, ALEXANDER. For references in this article to books or articles not already specified see Bentham's preface to his *Flora Australiensis* and article in the *Journal* of the Linnean Society, vol. xiii; Ettingshausen's *Die Genetische Gliederung der Flora Australiens*, and his *Beiträge zur Kenntniss der Teritärflora Australiens* (translated in the *Memoirs* of the Geological Survey of New South Wales); Hedley in the *Proceedings* of the Australasian Association for the Advancement of Science, vol. v; Hooker's *Flora Tasmaniae*; Spencer Moore in *Natural Science*, vol. xv; Moseley's *Notes by a Naturalist*; Baldwin Spencer's *Report on the Work of the Horn Scientific Expedition*; Tate in the *Proceedings* of the A.A.A.S., vol. i; and Woolley-Dod in the *Transactions* of the South Africa Philosophical Society, vol. xiv.



Botany Bay (from Atlas illustrating Cook's Voyage).

Botany Bay, an inlet on the eastern coast of Australia, five miles south of Port Jackson. The peninsulas forming its entrance (La Perouse and Kurnell) are government reserves; the rest of its shore-line is occupied by suburbs of Sydney. Cook's River flows into its north-western corner, and George's River into the south-western.

It was in Botany Bay, just within the entrance of the southern (Kurnell) peninsula, that James Cook made his first landing on Australian soil. The *Endeavour* lay off the peninsula from 29 April to 7 May, and Cook and Banks explored the shores of the bay and the inflowing streams as fully as was possible in the time. The name first given to it, according to Cook's log and Banks's journal, was 'Sting-Ray Harbour' or 'Stingrays Bay:' the name 'Botany Bay' first appeared in Hawkesworth's account of Cook's voyage, and it was for long believed that Hawkesworth himself had invented it. But the evidence, discovered later, of Banks's autograph journal cast a doubt on this belief; and the discovery in 1921 of Cook's autograph journal (see COOK, JAMES) has settled the matter once for all. In it the words 'Sting Rays Harbour,' which were first written, are deleted in favour of 'Botanist Bay,' and this again is corrected to 'Botany Bay;' the reason assigned for the change is 'the great quantity of New Plants &ca. Mr. Banks and Dr. Solander collected in this place.'

The alterations, which are in Cook's own handwriting, indicate that the change of name was made by Cook himself; but the Banks journal shows that it was not made until some time after the *Endeavour* had left the Australian coast, since Banks in his summary of Australian conditions used the first name. It is probable that during the long homeward voyage Cook revised his journal—possibly he read it to Banks—and in two revisions arrived at the more euphonious name, but did not trouble to alter the log, or to mention the change to his officers.

Bot-flies, insects of the family Oestridae whose larvae (the 'bots') infest the stomachs or other internal organs of several domestic animals. The only known endemic bot-fly is one (found only in the larval form) that infests the throats of kangaroos in Queensland and north-western Australia. But several of the more serious pests of stock have been introduced, and two at least—the horse-bot and the sheep-bot—annually cause the deaths of many animals. The ox-bot (*Hypoderma bovis*) has so far not become established in Australia, but has often been seen on imported cattle in quarantine.

The Horse Bot-fly (*Gastrophilus equi*) probably attacks all horses running free in Australia; its eggs, usually laid on the hairs about the chin and fetlocks, are a very common sight, as many remain on the hairs after the larvae have hatched. On being licked into the mouth or taken with food they pass into the stomach, to the walls of which they fasten themselves, frequently in the region of the pylorus; or they may become fixed to parts of the intestines or rectum. Here they remain for several months, till ready to mature, when they pass out with the dung and burrow into the ground to pupate. When but a few are in the stomach, little harm results; but they are frequently so abundant as to occupy all the available space, so that the horse rapidly loses condition and dies. The mature flies have a terrifying effect upon horses, which gallop about or become restive when they hear them. To minimise their attacks a common plan is to singe the hairs on which the eggs are laid, or to rub them with an oily rag; once in the stomach, little can be done, as the maggots are capable of withstanding most drugs that can be safely administered.

The Sheep Bot-fly (*Oestrus ovis*) occurs with sheep in several parts of Australia, and it is probably only a matter of time before all the States will be affected. Maggots (rarely eggs) are laid on the sheep's nose, and at once work their way up the nasal passage to the frontal sinus, where they usually remain till ready to mature; they then pass down the nostrils and drop to the ground. Occasionally they work their way into the brain, through openings in the ethmoid bone. The ceaseless irritation caused by these maggots, when in numbers, frequently results in death; but before dying the sheep will often run about in an aimless way, butting into everything in its way and frequently sneezing.

The Camel Bot-fly (*Cephalomyia maculata*) at one time or another attacks all camels in Australia. As a string of these animals goes along, one or other of them is frequently seen to stop and sneeze violently, discharging a maggot in the process.

R.J.T.

Bottle-brush. See BANKSIA and CALLISTEMON.

Bottle-tree (*Brachychiton rupestris*), known also as Gouty Stem, owing to the shape of the swollen trunk, which is contracted at the base and apex, is a large tree confined to Queensland and northern Australia, with leaves entire (or divided into 5-9 lobes) growing on the sterile branches. The stem abounds in a mucilaginous substance, resembling tragacanth, which is wholesome and nutritious and used as a food by the aborigines. The gummy exudation is remarkably like paraffin in appearance. The swollen trunk is a reservoir of water. The natives obtain an abundant supply of the sweet mucilaginous juice by cutting holes in the trunk. Specimens are sometimes 50 to 60 feet high, with a diameter where the trunk is thickest of 6 or 7 feet.

Boucaut, SIR JAMES PENN (1831-1916), son of Captain Ray Boucaut of the East India Company's service, was born near Falmouth in Cornwall on 29 October 1831, and educated locally. In 1846 he accompanied his father to South Australia, and after a few years on a station turned to the study of the law and was called to the local bar in 1855. Entering politics, he became successively member for Adelaide (1861-2), West Adelaide (1865-8), the Burra (1868-70), West Torrens (1871-5), and Encounter Bay (1875-8), and was three times attorney-general and three times premier (1866-7, 1875-6, 1877-8). During his second premiership he initiated a far-reaching public works policy. In 1878 he left politics for the bench, taking a supreme court judgeship, which he relinquished in 1905. In this period of his life he was twice administrator of the government, several times deputy-governor, and twice (1892 and 1897) acting chief justice. After his retirement he devoted himself to breeding pure Arab horses, and wrote a book on the subject—*The Arab, the Horse of the Future* (1905). He died on 1 February 1916.

Boucaut is particularly notable as a politician for two things—his refusal to borrow profusely without providing safeguards (an uncommon thing in the seventies), and his devotion to Australian rather than to local interests. He was one of the first advocates of inland railways con-

necting South Australia with the western districts of New South Wales, and eventually with Queensland. (K.C.M.G., 1898).

Bounty, MUTINY OF THE. Although this notorious event is in no way connected with the history of Australia, its discussion here seems sufficiently justified by the facts that (*a*) the officer against whom it was directed afterwards became governor of New South Wales, (*b*) Norfolk Island, a territory of the Commonwealth is populated with descendants of those Pitcairn Islanders whose existence is a direct result of the mutiny.

Several 18th century explorers of the South Seas having reported on the value of the breadfruit (*Artocarpus incisa*) as a food in hot climates, the West Indian planters petitioned George III to supply them with plants for acclimatization. In answer to this request the admiralty during 1787 fitted out H.M.S. *Bounty* (an armed transport of 215 tons) for the conveyance of a number of plants from Tahiti, and on the recommendation of Sir Joseph Banks gave the command to Lieutenant William Bligh. The crew—45 besides the commander—included John Fryer as master, Fletcher Christian as senior master's mate, four midshipmen, various petty officers, 23 able seamen and two gardeners. The *Bounty* sailed from Spithead on 23 December 1787, touched at Teneriffe, Simon's Bay, and Adventure Bay in Tasmania, reached Tahiti on 25 October 1788, and spent nearly five months loading plants in Matavai Bay. According to Bligh's narrative, all had so far gone well; according to all other witnesses at the subsequent court martial, there had been constant friction between the commanding officer and his subordinates. The *Bounty* left Tahiti on 4 April 1789. On the 28th, just as day was breaking, Bligh was rudely awakened by Fletcher Christian and three seamen, forced on deck at the points of their weapons, and with 18 others sent adrift in the ship's launch. Among the 18 who stood by Bligh were the master of the *Bounty*, the acting surgeon, botanist, gunner, boatswain, carpenter, one master's mate, two midshipmen, two quartermasters, and the sailmaker; with Christian stayed three midshipmen, the master-at-arms, six minor petty officers, and 14 sailors. The *Bounty* then trimmed sails and disappeared. In the launch (a boat 23 feet long, six feet nine inches in the beam, and two feet nine inches in depth) had been placed 32 lb. of pork, 150 lb. of biscuit, a 28-gallon cask of water, six quarts of rum, and six bottles of wine, besides canvas, twine, a few empty watercasks, and four cutlasses; Christian also gave Bligh his sextant and a book of nautical tables. Bligh found himself a few miles S. of Tofoa (one of the Friendly Islands) and decided to make for it, but after reaching it that evening and staying there until 2 May was driven away by a sudden attack of the natives, who killed one of the seamen.

When the *Bounty* left England the 'First Fleet' of transports for Botany Bay had been gone about seven months, and Bligh had no means of knowing whether the enterprise had been successful. He could not, therefore, count on obtaining help in that quarter. On the other hand, to settle down on a Pacific island, even if the natives permitted it, would minimize his chances of ever reaching England again. He therefore determined to make the north coast of New Holland and thence endeavour, by following Cook's route, to reach some European settlement in the Malay Archipelago.

On the 26th day of the boat-voyage breakers on the Barrier Reef were sighted, and two days later Bligh found a passage through the reef (now marked on the charts as Bligh's passage in 12° 51′ S. lat.) a little S. of Cook's Providential Channel. Inside the reef the party found smooth water and a resting-place on what is known as Restoration Island, about 500 yards offshore opposite Cape Weymouth. A week's voyaging along the coast took them to and through Torres Straits past Sunday Island, Wednesday Island, Shoal Cape and Booby Island; Koepang was reached on 15 June, 41 days after leaving Tofoa. During this time 18 men on very short rations in an open boat had voyaged about 3600 miles, encountering many storms and much rain, and at Koepang they were so cramped and weakened that they could scarcely crawl up the beach. Nelson the botanist died at Koepang of the effects of the voyage; when in a hired vessel they reached Batavia, Ledward (the acting surgeon) decided to remain there, and Elphinstone (master's mate) and two seamen, Linkletter and Hall, succumbed to fever. Bligh and the rest soon obtained a passage home, and reached England in March 1790.

The British government promptly fitted out the *Pandora* frigate (Captain Edward Edwards) to search for the mutineers. She took with her Hayward and Hallet, who had been with Bligh in the boat, and reached Matavai Bay on 23 March 1791. Before her anchor was down the midshipmen Stewart and Heywood, with a seaman named Coleman, came off in a canoe and surrendered, and a few hours later 12 others were made prisoners. They informed their captors that the *Bounty* under Christian's command had, after casting Bligh adrift, visited Tubuai in the Society group and then returned to Tahiti. Later on the mutineers had agreed to separate, and Christian—taking with him eight of the crew, three Tubuaians with their wives, three Tahitians with their wives and one infant girl, and ten other Tahitian women—had sailed with the *Bounty* to an unknown destination. Two of the mutineers who were left on Tahiti had been killed in a quarrel; others had built a small vessel, which they named the *Resolution*, in which to attempt the voyage to Batavia. Stewart had married a native woman. She died of grief soon after her husband was taken away in the *Pandora*, and her infant daughter, brought up by missionaries who subsequently landed on the island, survived until quite recent years.

The *Resolution*, manned by a small crew from the *Pandora*, was sent with one of the ship's boats to search the group; the boat was never afterwards heard of, and the *Resolution* not seen again until after an adventurous voyage she rejoined the *Pandora's* crew at Samarang. There she was sold, and afterwards purchased at Canton by Captain Broughton to assist him in surveying the coast of Tartary; during this part of her career she was the means of preserving the crew of H.M.S. *Providence*, when that ship was wrecked off Formosa in 1797. The *Pandora's* voyage was continued with her 14 prisoners confined in a wooden cell 11 feet by 18 (built on the quarter-deck for the purpose, and familiarly known as Pandora's Box), until on 28 August while working her way through Torres Straits in 11° 25′ S., she struck a reef and became a total wreck. (The ship's log, incorrectly, gave the latitude as 11° 20′ S.) The ship's company with the greatest difficulty managed

to save all but 29 of their number, among whom were four of the *Bounty* prisoners. In four boats the remaining 135 made their way to Timor, reached it on 19 September, and were ultimately brought to England. By a court martial assembled to deal with the 10 survivors of the *Bounty's* crew four were acquitted and the rest sentenced to death. Morrison (petty officer) and Heywood (midshipman) were both strongly recommended to mercy, the former because it was clearly established that he had done all in his power to prevent the mutiny; Muspratt (seaman) was at the last moment respited for the same reason. Heywood was a boy of 15 at the time of the mutiny, and it was clear that he had no knowledge of it until after the boat was cast off. Morrison afterwards rose to be a warrant officer, and was drowned in the *Blenheim* in 1807. He had kept a journal of the whole affair, which, borne out as it is by other evidence, is a reliable authority on the subject. Heywood was restored to his rank, and afterward became a post-captain and a distinguished officer in the service. The conduct of Edwards to his prisoners, both before and after the wreck of the *Pandora*, has been condemned as brutal by all writers, including officers in the service; Barrow, secretary to the admiralty, is one of the severest of his critics.

Nothing more was heard of the *Bounty* until in March 1809 Captain Folger of the American whaler *Topaz* reported that he had discovered on Pitcairn Island the last survivor of the mutiny with a small community of the mutineers' descendants. England was too busy with the war against Napoleon to attend to the report; but in September 1814 two frigates—the *Briton* and the *Tagus*, under Sir Thomas Staines and Captain Pipon—visited the island. Pitcairn had been lost sight of since its discovery in July 1767 by Carteret, who fixed its position wrongly. The visitors of 1814 received from the lips of John Adams (*alias* Smith), the surviving mutineer, an account of the happenings which there is no reason to doubt. Christian, made commander by consent of the rest, decided after leaving Tahiti to make for Pitcairn, and after some difficulty found the island and ran the ship ashore on a sandy beach. Taking all that was of value from her they made for themselves a comfortable home, planting food-stuffs and rearing pigs from stock brought in the ship. The quarrels that soon began ended in the death by violence of all the male natives and several whites, including Christian himself. Adams then took charge of the settlement, taught the people to lead decent lives, and died a respected man on 29 March 1829.

In the *True Briton* of 12 September 1796 a statement appeared to the effect that Christian was then living in South America. What purported to be a full account of the *Bounty's* cruise after the mutiny was also given as allegedly received by a correspondent from the lips of Christian himself (it should be noted that this account represents Christian as acquitting Bligh of all blame for the mutiny). Barrow states that about 1808-9 a rumour was prevalent that Christian had been seen in the neighbourhood of the Cumberland lakes, his former home; also that Heywood had seen Christian in Plymouth. It seems probable that this and similar statements were purely imaginative, and the *True Briton's* story may even have been invented in Bligh's interests.

Of the true causes of the mutiny nothing can be said with certainty. But it is certain (for no one except Bligh himself has ever denied it) that life aboard the *Bounty* was anything but pleasant; there were repeated floggings, and Bligh's language and conduct towards both officers and men were consistently offensive. Fryer the master, one of Bligh's staunchest supporters, gave evidence that Christian's last words before cutting the boat adrift included 'I have been in hell this last fortnight . . . . during the whole voyage I have been treated like a dog.' The contrast between life aboard under such conditions and the easy life of the stay at Tahiti would be sufficient inducement to many of the crew to join in a mutiny designed by officers with a more particular grievance. Barrow, himself a secretary to the admiralty, says explicitly that on the evidence taken at the court martial Bligh was responsible for what happened.

Bligh's side of the case is stated in his *Narrative of the Mutiny on board His Majesty's Ship 'Bounty'* (London, 1790), which however deals almost entirely with the boat-voyage. The original MS. of this book is in the Mitchell Library. Barrow's *Eventful History of the Mutiny and Piratical Seizure of H.M.S. 'Bounty'* (London, 1831) is probably the most impartial account of the transactions; Lady Belcher's *Mutineers of the 'Bounty'* is somewhat biassed by the fact that she was a step-daughter of Heywood, against whom Bligh used all his influence at the court martial. Hamilton's *Voyage Round the World in His Majesty's Frigate 'Pandora'* (Berwick, 1793) is the chief authority for that ship's doings. Judge McFarland of Sydney in 1884 published *The Mutiny in the 'Bounty,'* a highly judicial utterance; and Lord Byron's *The Island* and Becke & Jeffery's *The Mutineer* are fiction (in verse and prose respectively) based on the mutiny and its consequences. W. J.

Bourke, Sir Richard (1777-1855), born in Dublin on 4 May 1777 and educated at Westminster School and Oriel and Exeter Colleges, Oxford (B.A., 1798), was trained for the bar, but abandoned law to enter the army on 22 November 1798 (ensign, 1798; lieutenant and captain, 1799; major, 1808; colonel, 1814; major-general, 1821; lieutenant-general, 1837; general, 1851). After terms of service in Holland (1798-9) and South America (1806-7), he was in 1808 made assistant-quartermaster-general of Wellington's army in Portugal, and, knowing Spanish, became liaison officer with the Spanish army under Cuesta, but in 1809 for an unknown reason resigned his post and returned to England. In 1812 he went back to Spain in the same capacity as before, and controlled the issue of supplies to the army from Corunna until the war ended. From 1814 to 1825 his career is obscure, but in the latter year he was appointed lieutenant-governor of the eastern province of the Cape Colony (and in 1826-8 acting governor of the whole colony), where he had to deal with agricultural and press troubles very similar to those he at a later date encountered in New South Wales. His sympathetic treatment of the Kaffir tribes on the eastern border was resented by the Boer farmers of his province, and had a good deal to do with the 'great trek' of 1835. In November 1828 he returned to England, and with Lord Fitzwilliam edited in 1829 the *Letters* of Edmund Burke, who according to some authorities was his relative, and whom he had frequently visited at Beaconsfield in his youth. In 1831 he was chosen to succeed General Darling as governor of New South Wales, and reached Sydney on 2 December.

His term of office was much troubled, but important results were achieved and more important reforms devised and prepared for. The revolt of the emancipists (q.v.) against the long-continued rule of 'exclusive' officials, tolerated or sup-

ported by Brisbane and Darling, was at its height. Bourke attempted with a good deal of success to ignore both parties and to decide questions, as they came up, on their own merits; he thus provoked the enmity of the disappointed of both factions, but in the end removed the reasons for the existence of any such factions. He minimized the evils of the assignment system (q.v.) and substituted for it as a source of labour the introduction of free labourers from England. He passed a Church act which did away with many religious grievances, and was the nearest approach to religious equality that the colony achieved for many years. He initiated a system of civilian juries, on which emancipists might sit, for criminal trials. He abolished the system of land-grants, substituting sale of crown lands by public auction, and used the proceeds (so far as lay in his power) to pay the passages of the migrant labourers already mentioned. He completely freed the press, and even invited reporters to attend meetings of the council. He established the first savings-bank, encouraged the first mechanics' institute, and much improved the means of public education. Mitchell's explorations of 1835-6 owed a great deal to his encouragement, and the lasting nature of the Batman-Fawkner settlement on Port Phillip was largely due to his discreet handling of a very difficult situation. He also devised the 'squatting' system, whereby stockowners who were trespassing on the colony's lands beyond the bounds of settlement could obtain for a small annual fee a licence to go on trespassing; this device gave room for the growth of the valuable wool industry without disposing irrevocably of land that might some day have a much increased value. Besides all these actual achievements he managed by his influence, both in the colony and with the British authorities, to create an atmosphere of peaceful and humane progress in which social and political reforms throve, and which came to fruition under his successor. It is not suggested that he personally and alone was responsible for all the reforms just enumerated. Several of them were directly ordered by the British government, and others owed a good deal to the wisdom of local statesmen. But it was Bourke's tact and sympathy that ensured their successful adoption at a time when his official superior, Lord Aberdeen, used to declare that hot water was the favourite element of colonial mankind; a good many of them were initiated by himself; and the common sense of the colonists did not err in attributing to him, in an inscription on the base of his statue in the Sydney Domain, the credit for them all.

In 1837 Bourke found it necessary to suspend C. D. Riddell, the colonial treasurer, from his position in the executive council. Lord Glenelg, the then colonial secretary, instead of confirming the suspension, ordered Riddell's reinstatement when he should have apologized to the governor at a council meeting. Bourke, pointing out that Riddell's insults had been public while his apology would have been private, promptly resigned, and so on 5 December 1837 ended the colonial labours of the most popular governor New South Wales has ever had. Returning to England via Valparaiso, the Uspallata pass over the Andes, and Buenos Aires, he was offered first the governor-generalship of Jamaica (which he refused because the powers were too limited) and then—unofficially—the command of the British forces in India, which he declined for reasons of health. He retired to his estate at Thornfield in Limerick, lived there quietly for another 17 years, and died on 12 August 1855. (C.B., 1815; K.C.B., 1835).

Bowen, Sir George Ferguson (1821-1899), born in Ireland on 2 November 1821 and educated at Charterhouse and Trinity College, Oxford (B.A., 1844; M.A., 1847; hon. D.C.L., 1875; hon. LL.D., Cambridge, 1886), was trained for the law, but in 1847 was made president of the university of Corfu, and in 1854 chief secretary of the Ionian Islands. In this capacity he advocated the surrender of the southern islands to Greece and the retention of Corfu and Paxo (whose population was mainly Italian) within the British Empire. In 1859 Bulwer Lytton, then colonial secretary, made him first governor of Queensland, and for the next 20 years he was entirely concerned with various colonies of Australasia. During his eight years' term in Queensland he encouraged exploration, local defence, and the importation of Kanakas, but earned some unpopularity by refusing to allow the issue of unconvertible paper currency during a financial crisis. In 1867 he was transferred to New Zealand to succeed Sir George Grey, and soon found himself confronted by the rebellion under Te Kooti and by a simultaneous outbreak of Hauhaus on the west coast, but managed both to suppress the outbreaks almost entirely with local troops (the British regiments having been withdrawn) and by just treatment to soothe the disquieted Maoris and restore a healthy peace. His tact and energy were rewarded by promotion to the governorship of Victoria in 1872. Here he was involved in bitter quarrels between assembly and council, which are more fully narrated under Berry, Sir Graham, and on the whole question took the attitude that had been fatal to a predecessor, Sir Charles Darling, in McCulloch's time—that the dispute was of local, not Imperial, interest, and that he must therefore accept the advice of his ministers; there is no doubt, however, that he fully sympathized with Berry's actions. The British authorities were by this time more used than they had been in Darling's time to the political civil wars of the colonies, and Bowen got off lightly, being merely transferred in 1879 to the Mauritius, a little before his Victorian term had really ended. At the Mauritius (1879-1882) he did little more than routine work; but at his next post, Hong Kong (1882-5), he reconstructed the local legislature and ably kept the peace with France and China while those two countries were at war in 1884-5. Returning to England in 1886, he received many honours for his long and on the whole successful services, was entrusted in 1887 with a mission to Malta in connection with that island's new constitution, helped in the compilation of his memoirs (*Thirty Years of Colonial Government*), and died at Brighton on 21 February 1899. His first wife, Diamantina Countess Roma, daughter of the president of the Ionian senate in 1856, is commemorated in the names of a Queensland river and town.

One of Bowen's special characteristics was a readiness to correlate contemporary phenomena with the more ancient history which he studied lovingly to the day of his death. It was natural that at Corfu he should pursue Homeric studies and attempt (though in vain) to make indisputable the identification of the island with Homer's Ithaca. But Queensland was as full of classical reminiscences for him as Corfu, and the Darling Downs reminded him of Thessaly, while the squatter-selector controversies seemed a replica of Roman quarrels over the *ager publicus*. In New Zealand he launched out into

deeper waters; compared Te Kooti's rebellion with the Indian mutiny, and the tribal system existing in New Zealand with the remains of the clan system as it existed in Scotland at the beginning of the 18th century; and explained the Maoris with parallels from the Bible and Sir Walter Scott. To the severely practical colonial mind this savoured of pedantry; but a serious study of such parallels—especially of those drawn from Greek and Roman history—would have saved Australia many evil days. (C.M.G., 1855; K.C.M.G., 1856; G.C.M.G., 1860.)

Bowen. George Meares Countess (1803-1889), in no way related to the Bowens of the naval service mentioned below, was educated at the military college at Sandhurst and in 1821 commissioned lieutenant in the 39th regiment. In 1827 he accompanied a detachment of his regiment to New South Wales, but almost immediately resigned his commission to become, at Governor Darling's request, an assistant surveyor under the government. Darling in 1828 made him a commissioner 'for apportioning the territory' and in September granted him—as though he were still a military officer—2560 acres, which Bowen located on the Falbrook beyond Singleton. The colonial office, however, disallowed the commissionership, and Bowen retired from the service, had his grant transferred from the Falbrook to Mount Tomah beyond Windsor, and settled down in that district as a farmer and magistrate. His residence was at Bowen Mount on the Kurrajong Hills, but he began the erection of a fine stone mansion on the Bell's Line road near Mount Tomah, the remains of which are still known as 'Bowen's Folly.' Bowenfels, a township at the western extremity of the original Bell's Line, was named after him: but the name when given was purely English, Bowen Fells. As early as 1846, however, mapmakers had introduced the foreign spelling, though the older remained in use for many years later. Gipps made Bowen police magistrate at Berrima, but refused him leave to visit England in 1843. He died on 1 September 1889.

Bowen. John (1785?-1827), was one of a numerous family, nearly all connected with the navy, whose names occur frequently in early Australian history. At his death he was said to be 42 years old, which would make the date of his birth 1784-5; but King would hardly have entrusted the founding of a new settlement to a boy of 18. He was educated at the royal naval college, and left it in 1798 to join the navy (midshipman, 1798; lieutenant, 1802; commander, 1804; post-captain, 1805), serving at first under his father, James Bowen, who is discussed later. He served in the Mediterranean (1798-1800) and on the Cape station (1801), and in May 1802 was made junior lieutenant in H.M.S. *Glatton*, which reached Port Jackson on 11 March 1803. He at once volunteered for colonial service, and on the 18th King proposed to send him to Norfolk Island as acting-lieutenant-governor, but within 10 days cancelled this appointment and put him at the head of the expedition destined to make a settlement on Storm Bay. For his work on this task see Tasmania. During a visit to Sydney in January 1804 he heard of the renewal of the war between France and England, and at once asked to be relieved of his local duties so that he might return to Europe; after some confusion this was arranged, and he left Sydney for England on 21 January 1805, carrying King's despatches to the colonial office. It is usually stated that he fought at Trafalgar, was promoted post-captain immediately afterwards in honour of the victory, did escort duty with convoys from 1806 to 1809 in the *Camilla*, and served on the East Indies station in the *Salsette* in 1812-16; but it seems remarkable that a junior lieutenant of 1802 should be a post-captain by 1805. He died at Ilfracombe on 20 October 1827.

James Bowen (1751-1835), John's father, was born at Ilfracombe, entered the merchant service about 1766, and joined the navy about 1777. He was master of Lord Howe's flagship in the battle of the 1st of June, 1794, and by very rapid promotion was captain of his own ship within 15 months; in 1803 he was appointed a commissioner of the transport board, in 1816 a commissioner of the navy, and retired in 1825 with the rank of rear-admiral. He died on 27 April 1835. His services to the nation were numerous and important; but his only connection with Australia (outside his parentage of John Bowen) lies in his signature to letters as a transport commissioner or a commissioner of the navy. His brother Richard Bowen (1761-1797), of whom Nelson said 'A more enterprising, able and gallant officer does not grace His Majesty's naval service,' was in 1791 naval agent aboard the transport *Atlantic*, which on 18 August discovered, and took shelter from adverse winds in, a bay which he named Jervis Bay after his old commander. He also under Phillip's instructions sailed the *Atlantic* from Norfolk Island to Calcutta in the teeth of the north-east monsoon, was delayed for two months in India loading stores, started back with the vessel 'as deep in the water as a sand-barge,' and reached the island again within 7½ months from his departure. On returning to England he recommended the supplying of New South Wales with live stock from Madura and Timor. He was killed on 24 July 1797 during Nelson's attack on Santa Cruz. James Bowen, captain in the navy, who commanded the sea forces at Madeira when the *Investigator* visited that island in 1801, and after whom Flinders named Bowen in Queensland, was possibly Admiral Bowen, but may have been his eldest son.

A George Bowen, master of the transport *Albemarle* in 1791, did not belong to this family; neither did a 'Mr.' Bowen who was second mate of the *Lady Nelson* when Grant took her to Western Port and Port Phillip.

Bower-birds, perching birds belonging to the family Ptilonorhynchidae, peculiar to eastern and northern Australia and New Guinea. Many of the bower-birds are brilliantly plumaged; the majority build structures of various kinds, composed of sticks, round which they collect brightly-coloured objects, and in and about which they spend a great deal of time, arranging their treasures and playing with one another. These structures (generally called bowers) are quite distinct from the nests, which are of the ordinary cup-shaped form and are built in trees and bushes. The different genera of the family present great differences in habits, and in coloration both of the birds and of the eggs.

The genus *Ailuroedus* contains the cat-birds, so called because their notes strikingly resemble the mewing of cats. They frequent tropical scrub country, feed on jungle fruits, and build bulky nests in bushes, not far from the ground. Their two or three eggs are cream-coloured,

without markings. They are not known to build any sort of bower. The two Australian species are the Green Cat-bird (*A. crassirostris*) of eastern New South Wales and south-eastern Queensland, and the Spotted Cat-bird (*A. melanotus*) of north-eastern Queensland; a third species is found in New Guinea. They are bright green above and yellowish-green below, spotted all over with white; they have very stout bills. The Tooth-billed Bower-bird (*Scenopoecetes dentirostris*) of north-eastern Queensland, the sole member of its genus, is characterized by tooth-like notches on the sides of its stout bill. It is dark greenish-brown above and brownish below with darker streaks. It frequents tropical scrubs. Its nest is a fragile structure composed of sticks, and the two eggs are of a greenish cream-colour without spots. This species is much more melodious than the cat-birds; it utters clear liquid notes, and mimics the notes of other birds. It does not construct a bower, but clears all the dead leaves

Bower of Satin Bower-bird.

and rubbish from a piece of ground (usually under a bush) and on it spreads a number of leaves spaced separately at about equal intervals apart. These are renewed every day, the withered leaves being removed, and the fresh leaves placed with their lighter side uppermost.

The Satin Bower-bird (*Ptilonorhynchus violaceus*)—also the only member of its genus—inhabits the coastal districts of eastern Australia from Queensland to Victoria. Young males and females are greyish-green above with brown wings and tail, yellowish beneath, with crescent-shaped dark-brown tips to the feathers. The eyes in both sexes are blue. When about seven years old the male acquires his adult plumage and is a rich, satiny, shiny blue-black all over. Satin-birds construct elaborate bowers (often called 'runs') in secluded places among the forest-covered hills, usually under the shade of an overhanging branch. Male birds do most of the work, the females occasionally assisting them. The base of each bower is a platform of interwoven sticks, on which are set two rows of more flexible twigs with their ends propped against each other, so as to leave a clear passage-way beneath. All round these 'runs,' and especially near the entrances, bright objects collected from the vicinity—such as shells, bones, feathers and flowers—are spread about, blue objects being especially sought after. At the beginning of the breeding-season the males show off before the females near and within these bowers, running round them and through the passage with bright objects in their beaks. Each bower is the playhouse for a colony of birds, and is in no way connected with nesting. The nests are cup-shaped structures of sticks placed in low bushes; the two eggs are cream-coloured, with blotches, spots, and streaks of brown and grey. Satin-birds, being fruit-eaters, visit orchards when the fruit is ripe, and are shot by the orchardists, so that their numbers are diminishing.

The Regent-bird (*Sericulus chrysocephalus*),

Regent-bird.

again the sole member of its genus, is confined to the scrubs of south-eastern Queensland and north-eastern New South Wales. The male—the handsomest of all bower-birds—is velvety black, with head, neck, back, and some of the wing-feathers a rich orange-yellow. The female is brown above, with a whitish head and under-parts, and black patches on the head and throat. This species feeds on insects as well as on berries and other fruits; its call is a single whistle. The nest is a slender structure, usually placed in a bunch of trailing creepers; the eggs are yellowish, with blotches of brown and grey and fine stripes and scrawls of reddish-brown. The bower is like that of the satin-bird but smaller and sometimes without any platform of sticks. It is decorated chiefly with berries, leaves, and snail-shells.

The Golden Bower-bird (*Prionodura newtoniana*) of north-eastern Queensland is golden-yellow in colour, with a broad crest on the head; the female is olive-green. It constructs bowers in which one side is composed of longer sticks than the other, so as to overlap it, and

decorates them with flowers. The females build bowers for themselves, smaller than those constructed by the males. The nest, built principally of leaves, is placed in a hollow in a stump or the buttress of a fig-tree. The two eggs are shining white.

The four species of *Chlamydera* are brownish birds, more or less spotted with paler colouring. The Spotted Bower-bird (*C. maculata*) is found throughout the inland districts of eastern Australia, the Western Bower-bird (*C. guttata*) in the centre and north-west, and the Great Bower-

Spotted Bower-bird.

bird (*C. nuchalis*) all along the north coast of the continent. These three species are adorned with a bright lilac-pink band across the back of the neck, larger in the male than in the female, and absent in young birds. The fourth species, the Fawn-breasted Bower-bird (*C. cerviniventris*), lacks this lilac band. Its range extends from Cape York to southern New Guinea and the Louisiade Archipelago.

The species of *Chlamydera* build longer bowers than their relatives, forming short avenues of twigs, inside which are grasses kept in position by stones at their base. Great piles of water-worn stones, shells, bones, and other objects are accumulated at each end of the bower, or are sometimes arranged in rows radiating outwards like paths. The bowers are the resort of many individuals, which apparently assist in their construction and chase one another through the passage. The nest is placed in a bush, and the eggs have a fine sea-green ground colour, blotched and marked like those of the regent-bird.

W.B.A.

Bowls. The first game of bowls played within what is now the Commonwealth was between T. Burgess and F. Lipscombe, at Lipscombe's home on Sandy Bay near Hobart on 1 January 1845. Burgess won the 'odd game out of 25.' In the same year William Turner laid down a green at his hotel on the Sandy Bay-road, which he named the Bowling Green Hotel; the green was in existence in the late fifties, and its stone retaining walls are still visible, the hotel having been converted into a private residence. On 28 October 1846 Turner formed the first bowling club, which included officers of the 96th regiment and leading citizens of Hobart. In 1852 a match between military and civilian teams was watched by nearly 1000 spectators who had paid for admission. The civilian team won.

The oldest existing green in Australia is that of the Melbourne club at Windsor, which was laid down by John Campbell in 1864 and opened on 22 October in that year. Campbell's attempts to form a club before the green was ready failed, and the expense of constructing it almost brought him to bankruptcy; but as soon as the green was in use there was a rush of members, and by the end of the year 182 were enrolled. The St. Kilda club was formed in the same year, its green being opened in 1865; the Fitzroy club in January 1865, and its green in November; the Ballarat also in 1865, the West Melbourne (now the City) in 1866, the Carlton in 1868, and the Richmond (now defunct) and Richmond Union in 1869. On 23 July 1880 these clubs, with three of later growth, formed the Victorian Bowling Association, with Samuel Amess as first president and M. Ellis as first secretary.

An engraving in the Mitchell Library at Sydney shows that the game was played in the grounds of the Sir Joseph Banks hotel at Botany so far back as 1854. It was, however, Alexander Johnstone of Parramatta who introduced the game to New South Wales under club conditions. For him Thomas Eades (also of Parramatta) in 1867 turned the first set of bowls made in the colony, and Johnstone practised with them in solitude in a paddock at Elizabeth Farm, until neighbours began to doubt his sanity. After a time he persuaded Andrew Payten of the Woolpack hotel to lay down a rink, and in 1869 three rinks were in use there. The Woolpack club—the first in the colony—was formed in 1870. In 1872 A. T. Holroyd (q.v.) laid down a rink at Sherwood Scrubs, his home near Parramatta, and formed a club composed mainly of English university men; in 1874 he published a set of 'rules which will regulate bowl-playing on my green.' In the same year W. F. Burkitt, an assistant-master at The King's School, Parramatta, completed a rink in the school grounds. The Woolpack club lived until 1880, when it was replaced by the Parramatta Bowling club.

In Sydney a club was formed in 1876 to play on a green made by Charles Moore, curator of the botanic gardens, in the Domain facing Macquarie-street; in 1878, however, its site was required for the exhibition buildings. Private greens were owned by E. W. Fosbery (inspector-general of police) and by John Young of Annandale, who in December 1878 formed the Kentville club and became known as 'the father of bowls.' Early in 1880 Young invited the Victorian clubs to send teams to Sydney, and on 12 April 1880 the first intercolonial match was played on the Kentville green, Victoria winning by 21 points (112 to 91). On 22 May was formed the New South Wales Bowling Association, comprising the Kentville, Balmain, Parramatta and City clubs, with John Young as first president and Thomas Richard Smith as first secretary. Between 1880 and 1896 19 intercolonial matches were played, Victoria winning 12 and New South Wales 7. In 1896 a new series of matches was inaugurated—three in Sydney and three in Melbourne each year, the rubber of each set to count as a win. Under this arrangement—only one set was played in 1896, 1912, 1913, 1917, 1919 and 1921, and no sets at all in 1897, 1899, 1901, and 1914-16—40 sets had been played up to the end of 1924 (one set in 1923 having been left unfinished), of which Victoria had won 23 and New South Wales 17.

In Queensland the Metropolitan Bowling club was formed in September 1878, using as a green

the lawn of the botanic gardens; this being taken for croquet-players in 1879, and a substitute green offered by the colonial authorities proving useless, the club in 1881 opened a green just beyond the railway-gates at Roma-street. This was resumed by the railway department in 1893, and the club then amalgamated with the Booroodabin (Breakfast Creek) club, which was formed in 1888. In 1903 the five clubs then in existence—Booroodabin, South Brisbane, Maryborough, Darling Downs, and Doon Villa (at Maryborough)—formed the Queensland Bowling Association. The first match between Queensland and New South Wales was played in 1904; it inaugurated a series of home-and-home matches of which (as there were no contests in 1914-7 and only one in 1918) there have been 33. Queensland has won 18 and New South Wales 15.

After the disappearance of Turner's green in the late fifties there is no record of Tasmanian bowls until 1883, when a club was formed at Launceston. In 1891 the Hobart club was formed, and in 1902 the two clubs formed the Tasmanian Bowling Association. Launceston produced a second club (the A.B.C.) in 1898, and Hobart others in 1905 (the Buckingham) and 1907 (the Sandy Bay). In 1904 a Tasmanian team visited New South Wales.

In South Australia the Adelaide club was formed on 18 February 1897, its green being opened late in 1898. The Adelaide Oval club was established in 1901, and in 1902 these two clubs formed the South Australian Bowling Association. Intercolonial matches followed, the first against New South Wales in 1902, the first against Western Australia in 1903; but these have not become regular fixtures.

In Western Australia the Perth club was formed in 1894, and its green opened in 1895. The Fremantle club, formed in 1896, and the Swan club, formed at East Guildford in 1897, joined in September 1898 to form the Western Australian Bowling Association.

The strength of the various State associations at the end of 1924 was:—Victorian, 67 metropolitan clubs, 82 affiliated country clubs; New South Wales, 32 metropolitan, 51 country; South Australian, 28 metropolitan, 24 country; Queensland, 29 in all; Western Australian, 19 metropolitan, 17 country; Tasmanian, 17 in all.

In April 1911 an Australian Bowling Council was formed to manage inter-State and international games, and under its auspices the first bowling carnival was held in Melbourne in December 1912; subsequent carnivals have been held in Brisbane (1914), Adelaide (1921-2) and Perth (1924), each controlled by the State association under the council's auspices. The team championship was won in 1912 by Victoria, in 1914 by Queensland, in 1921 by South Australia, and in 1924 by Western Australia—in every case the local team was the winner.

In 1899 an attempt was made to arrange a visit from a representative English team, but the lack of a central body in England made negotiations difficult. In August of that year, however, the International Bowling Association was on John Young's initiative formed in London, with Lord Jersey (q.v.) as its first president; and in 1901 a combined New South Wales and Victorian team visited England, playing 22 matches, of which they won 11 and drew one. A New South Wales team went to England in 1912, winning 30 games and losing 24. The first team representing all Australia visited Britain in 1922 under the joint auspices of the Australian Bowling Council and the International Bowling Board of Great Britain; out of 40 matches it won 23 and drew one.

In 1925 the Australian Bowling Council decided that all bowls should in future be standardized by the table test; that all, whatever their material, should conform to a standard shape; and that the maximum weight for a given major diameter should be determined according to a fixed scale, the maximum for a ball of 5 3/16 in. diameter being 3 lb. 8 oz., that for a ball of 4¾ in. diameter 3 lb. 2 oz., and for intermediate sizes in proportion. A variation of 1/32 in. is allowed either way, and the diameter between discs must be from 7/16 to ½ in. less than the major diameter.

W.A.B.
J.P.M.

Box, a name applied chiefly to a section of the genus *Eucalyptus* (q.v.), but occasionally to trees of other genera. The brush box is a *Tristania,* the China box a *Murraya.*

Box-fishes (Ostraciidae), an extraordinary group of fishes which, though generally distributed throughout temperate and tropical seas, are more plentiful and of greater variety in Australian waters than elsewhere. The head and body are encased in a hard carapace formed of scutes immovably anchylosed together, leaving only the fins free; these project upon short fleshy bases. The carapace is commonly provided with several keels (or crests) and with strong fixed spines that change their form with growth, the young being more spinate than adults. Most of the species are highly ornate, with amazingly brilliant colours and patterns. They are also known as coffer- or trunk-fishes. A common tropical representative is called cow-fish, on account of two long spines that project forwards from the forehead like a pair of horns. They are related to the leather-jackets and toadoes, and, notwithstanding their forbidding appearance, are sometimes eaten by the aborigines, who roast them in their shells. The Horned Box-fish or Cow-fish (*Ostracion cornutus*) is a common tropical species which occasionally wanders southwards to Port Jackson. It has two long spines projecting forward from the forehead like horns, and two others pointing backwards near the tail.

A.R.McC.

Boxing. See Pugilism.

Boyce, William Binnington (1804-1889), born at Beverley in Yorkshire on 9 November 1804 and from his early youth devoted to religious duties, was in 1829 accepted as a missionary probationer and sent to South Africa by the Methodist committee. Here he spent 13 laborious years, mostly in Kaffraria, and earned a reputation for scholarship as well as for courage. In 1843 he returned to England, was for two years in charge of a church at Bolton, and in 1845 was despatched by the English conference to New South Wales to set up the machinery for local government in Church affairs which the conference was ready to grant to its Australian adherents. He reached Sydney in 1846, and soon became a prominent figure in the life of the colony. When in 1850 the university of Sydney was founded, Boyce was one of the 16 original senators, and a member of the first library committee; in later years he gave the library a valuable collection of Oriental literature. His work for his Church was continuous and masterly. He was general superintendent of missions before the establishment of the Australasian conference, and presided at the first two meetings (1855

and 1856) of that conference. In 1847 he published a newspaper, the *Gleaner*, and in the next year incorporated it with the *Christian Standard*. When local self-government in church affairs had been established, Boyce returned to England and for 18 years worked there as one of the secretaries to the foreign missions committee. In 1875 he came back to Sydney, settled at Toxteth Park in the Glebe, and officiated occasionally at the chapel erected there by Sir G. Wigram Allen (q.v.). During these years he took up with zeal the study of philosophy and history, and published in 1878 *Six Lectures on the Higher Criticism of the Old Testament* and in 1884 an *Introduction to the Study of History*, both based on very wide reading of English and German authorities. He died suddenly at Toxteth on 8 March 1889.

J.C.

Boyd, BENJAMIN (1803-1851), born in London and educated in Scotland, in 1824 returned to London to enter a financier's office; later on he became a member of the stock exchange and an original director of the Union Bank of London. In 1840 he founded the Royal Bank of Australia, and in 1841 the Australian Wool Company. Towards the end of that year he decided to visit Australia and establish a branch of the bank there, and on 23 December left Plymouth in the yacht *Wanderer*, reaching Sydney on 18 July 1842. He took with him his brother James Boyd and the artist Oswald Brierly (q.v.), and four vessels—the *Seahorse*, *Juno* and *Cornubia*, steamships, and the schooner *Velocity*—flying his 'two bees' flag and carrying his stores, preceded him to Port Jackson. In 1843 he opened his branch bank on Church Hill, and entered the whaling industry, making his headquarters for this purpose at Twofold Bay, where he founded twin townships (Boyd Town and East Boyd) astride the Towamba River. His main object, however, was to acquire wealth in pastoral enterprises; Boyd Town was to be the shipping centre for the Monaro plains, to which he constructed a road; and he took up under pastoral licence 800 square miles of country along the Murray between the Ovens and the Campaspe, as well as several blocks near Deniliquin. He also imported blood stock, and made himself so popular in Melbourne that from September 1844 to September 1845 he represented Port Phillip in the Sydney legislative council. Both on the Murray runs and at Boyd Town he employed Kanakas, being the first man to import them (in 1847) as labourers to Australia. Unfortunately for him they were ill-treated by their overseers, got out of hand, and became such a nuisance that the government ordered their deportation. For a time his many enterprises flourished, and Boyd Town was a regular port of call for vessels trading between Hobart, Melbourne, and Sydney; but in 1849 the crash came, and a few years later the bank —with whose funds the whole business had been financed—was wound up. The shareholders, in addition to losing their capital, had to make good a deficiency of £80,000. Boyd, who had been removed from control, was allowed to retain three whalers, the yacht *Wanderer*, and some land at Twofold Bay. On 26 October 1849 he sailed from Sydney in the *Wanderer*, went off to the Californian gold diggings, but met with no success, and then decided on a cruise amongst the islands of the Pacific; it was asserted by one of his companions that he hoped to establish a 'Papuan republic or confederation.' The *Wanderer* left San Francisco on 4 June 1851, and on 10 September reached San Cristoval in the Solomons. On 14 October they anchored in a small bay on the west coast of Guadalcanar, and next morning Boyd (taking one of the native crew) went on shore to shoot game, and was never seen again. About breakfast-time the natives made an attack on the yacht, and with great difficulty were beaten off. A landing and search for Boyd proved unsuccessful, no traces of him being found but his belt and some wadding from his cartridges. The search was repeated during several days, but without result, and on the 19th the *Wanderer* sailed for New South Wales, reaching Port Macquarie on 13 November; there she grounded off the southern headland and went to pieces. In 1854 rumours were current in Sydney that Boyd was still alive on Guadalcanar, but a renewed search had no success, and it is practically certain that he was killed by the natives soon after his landing on 15 October.

The most trustworthy account of Boyd's life may be found in the *Journal* of the Royal Australian Historical Society (vol. ii); and an account of Boyd Town in Wells's *Gazetteer of the Australian Colonies* (1848) is so elaborate as to raise a suspicion that Boyd subsidized the book. Webster's *Last Cruise of the 'Wanderer'* is also useful.

Brabyn, JOHN (1775-1835), apparently English-born, is first heard of when appointed to the New South Wales Corps (q.v.) on 6 May 1795 (ensign, 1795; lieutenant, 1800; captain, 1808; captain in the veteran company, 1811). He reached Port Jackson on 11 February 1796 in the *Marquis Cornwallis*, after a voyage almost frustrated by an attempt at mutiny among the troops and convicts. For some years he was stationed at Norfolk Island, where in 1800 he was concerned in the punishment of another convict conspiracy. In 1801 he returned to Sydney and was stationed at Parramatta, obtaining a grant of 200 acres from King and buying an additional 100 acres, on which he grew wheat and kept a few sheep. King liked him and eulogized his conduct during the Castle Hill mutiny of 1804. During Bligh's term he took part, as senior lieutenant, in the protest against the participation of Atkins in Macarthur's trial and in the deposition of Bligh that followed; at the end of 1808 he was transferred to Port Dalrymple, and then heard that on 13 February he had been gazetted captain. (These delays seem to have been frequent; Brabyn's lieutenancy, for instance, was gazetted in London on 15 August 1800, but he still ranked as ensign in Sydney on 15 September 1801.) At Port Dalrymple he took over charge from Paterson, allowing him to go to Sydney and supersede Foveaux; Paterson seems to have objected to his methods of administration, but Macquarie when he arrived found no fault with them. Consequently, although he was sent home with the Corps, he was on 5 February 1811 transferred to the veteran company and allowed to return to the colony. In 1817 he retired from military service and settled down to farming, obtaining in 1819 a grant of 1200 acres near Prospect (and others later); he was made magistrate at Windsor, but in 1827 was still reckoned a military officer on full pay, though in no way connected with the then veteran companies under Colonel Dumaresq. He died on 1 August 1835.

Brachychiton, a large, chiefly tropical genus of the family Sterculiaceae, most abundant in tropical Asia. Twenty species are endemic in Australia; they consist of trees with

variously divided leaves, flowers without petals —the enlarged coloured calyx provides a substitute—and frequently unisexual. *B. quadrifidus*, a species confined to Queensland and the Northern Territory, has brilliant scarlet fruits which, when open, display black seeds and are very ornamental. The seeds are edible, and taste like filberts. The mucilaginous substance of the fruit is also eaten. The roots of *B. trichosiphon* (the 'Ketey' of northern Queensland aborigines) are eaten without any preparation. The timber of *B. discolor* is white and soft when cut, but hardens in drying, and makes good shingles. The bark yields a strong, useful fibre like bass or Russian matting. *B. rupestris* is described under BOTTLE-TREE, and *B. acerifolius* under FLAME-TREE. See KURRAJONG.

Brachycome, a genus of the family Compositae, chiefly indigenous to Australia; a few species occur in New Zealand. It has involucral bracts in 2 rows nearly equal; marginal florets numerous with narrow rays; achenes flat

Swan River Daisy.

with winged margins or obtusely 4-angled; pappus short or obsolete. *B. iberidifolia* (Swan River Daisy), an annual with blue or white flowers, is much cultivated as a border plant in gardens. *B. nivalis*, one of the snow daisies from Mount Kosciusko, is a white-flowered species with feathery foliage: *B. decipiens*, a coastal species, is also cultivated, and bears a strong resemblance to the common English Daisy (*Bellis perennis*).

Bracken-fern. See FERNS.

Braddon, SIR EDWARD NICHOLAS COVENTRY (1829-1904), son of Henry Braddon of Skisdon in Cornwall, and elder brother of the novelist best known as Miss Braddon, was born on 11 June 1829. In 1847 he went to Calcutta to work for a cousin's firm there, but after a few years joined the government railway service as assistant in the Santhal district, where he helped to suppress an outbreak. This brought him the appointment of assistant-commissioner (1857). During the Mutiny he raised a Santhal battalion, and served under Sir George Yule with much credit. For the next 20 years he occupied various posts in the Indian revenue service. Retiring on pension in 1878, he settled on the land in the north-west of Tasmania. Next year he entered the assembly as member for West Devon, became leader of the opposition in 1886 and (after refusing the premiership) joined the Fysh ministry in 1887 as minister of lands and works. In 1888 he was the Tasmanian representative on the federal council (see FEDERATION), and late that year left the ministry to become agent-general. Recalled to Tasmania at the end of 1893, he was re-elected for his old constituency and next year became premier. He retained this office until late in 1899, meanwhile taking a large share in the establishment of federation; he represented Tasmania at the convention of 1897-8, and was mainly responsible for the famous 'Braddon' clause (q.v.), also known as the 'Braddon Blot.' Elected to the federal house of representatives in 1901, he sat as a freetrader until 1904, when he died on 2 February. (K.C.M.G., 1891; P.C., 1897.)

Braddon Clause, THE. When the constitution of the Commonwealth was being shaped by the convention of 1897-8 (see FEDERATION), the disposal of Commonwealth revenues was found to be a difficulty. The various colonies had derived a good deal of their public funds from customs duties, which under any genuine form of federation must inevitably be collected by the central government. To avoid dislocation of colonial finances it was obviously necessary to secure to the several States a return of part at least of this customs revenue; there was also a good deal of hesitation about giving the new Commonwealth liberty to spend as much as it might like to. At the Adelaide meeting, therefore, it was agreed that federal expenditure should not exceed £1,550,000 annually, that the surplus should be distributed among the States in proportion to population, and that the sum so distributed should for five years after the imposition of uniform federal duties be not less than they had received in the last year under their own scales of duties. During the discussion on this scheme F. W. Holder of South Australia suggested that the Commonwealth should return to the States a fixed proportion —say 70 per cent—of the customs revenue it collected; but the suggestion fell flat at the time.

During the debates in colonial legislatures on the Adelaide draft of the Commonwealth bill, New South Wales deleted all these provisions,

and no colony except South Australia expressed satisfaction with them. At its Sydney meeting, therefore, the convention cancelled them and referred the whole matter to the finance committee; and at the Melbourne meeting in 1898 a completely new scheme was submitted, abolishing all guarantees. This did not please Victoria or Tasmania, but New South Wales advocated it.

After the third recommittal of the bill Sir Edward Braddon brought up the first draft of a clause providing that, out of the net customs and excise revenue, not more than one-twentieth should be spent by the Commonwealth in the exercise of its original powers, not more than four-twentieths should be spent upon transferred services, and the remaining three-fourths should be distributed among the States. The proposal was made in the small hours of the morning, towards the close of the sittings; it had been in print for some days; the convention had already discussed the whole question fully; and it was carried with hardly any debate by 21 votes to 18, the Victorians and Tasmanians voting for it and all the representatives of New South Wales (except W. J. Lyne) against it. Next day it was reconsidered, and Edmund Barton made an effort to limit it to five years. But his amendment was negatived, and the clause passed with an amendment providing that, when any part of a State's public debt was taken over, revenue returnable to that State might be devoted to the payment of interest. Finally Braddon consented to simplify his proposal by allowing the Commonwealth to spend one-fourth of the net receipts.

This clause was hotly opposed in New South Wales, where freetraders argued that, by compelling the Commonwealth to raise four times as much revenue as it required for its own use, the clause forced on the new central government some form of high protective duties. When (as is told under FEDERATION) the affirmative vote in New South Wales did not prove large enough to carry the bill, and Reid demanded of the subsequent premiers' conference amendments as the price of his support for a new referendum, one of them limited the duration of the Braddon clause to ten years after the Commonwealth came into being, unless the federal parliament liked to let it function longer. The clause, therefore, as embodied in the constitution (87) stood as follows:—'During a period of ten years after the establishment of the Commonwealth and thereafter until the Parliament otherwise provides, of the net revenue of the Commonwealth from duties of customs and of excise not more than one-fourth shall be applied annually by the Commonwealth towards its expenditure. The balance shall, in accordance with this Constitution, be paid to the several States, or applied towards the payment of interest on debts of the several States taken over by the Commonwealth.'

In actual working the clause proved unsatisfactory both to the Commonwealth and to the States; it deprived the one of funds that were often sorely needed, and did not function equally among the others—Queensland, for instance, in five years and Tasmania in two did not receive the full three-fourths of their share of revenue, since the clause did not specify that each individual State must receive that proportion, but only that in the aggregate that proportion must be distributed. Hence originated the frequently heard nickname, 'the Braddon Blot.' During the ten-years' term many attempts were made to recast the financial provisions of the constitution, and the argument that always induced the representatives of the States to modify their demands was that at the end of ten years the Commonwealth need not hand over any revenue at all. In August 1909, however, Alfred Deakin arranged with the State premiers that from July 1910 onwards the Braddon clause should disappear, and the Commonwealth should for the future pay each State 25s. per head of its population.

Under the Braddon clause the Commonwealth paid to the States in 9½ years (January 1901 to June 1910) the sum of £68,140,353. But, owing to the action of another clause (94) which ordered that the Commonwealth should also hand over to the States its whole annual surplus, the total payment to the States amounted to over 74 millions, or more than 81 per cent of the customs and excise revenue collected.

Brady, JOHN, born in Cavan, Ireland, was for 19 years a missionary in the island of Bourbon, but met Dr. Ullathorne while on a visit to Rome in 1837, was persuaded to offer his services for the Australian mission, and was detailed for duty at Norfolk Island. Reaching Sydney on 24 February 1838, he was sent by Bishop Polding to Windsor—a change which led to trouble with the colonial office, Dr. Ullathorne having secured the appointment on the ground that Norfolk Island was badly in need of a chaplain. At Windsor Father Brady was stationed for some years, and while there made a particular study of the needs and the language of the aborigines. In 1843 Dr. Polding, who trusted him greatly, sent him as vicar-general to the Swan River settlement. He reached Perth on 13 December, founded a church there before the month's end, and in the following April sailed for Europe to procure help for the new mission; while at Rome on this errand, he was consecrated bishop of Perth on 18 May 1845, and early in 1846 returned to Western Australia with a large number of priests and other helpers, including Dom Serra and Dom Salvado (q.v.). The diocese was extremely poor, and Dr. Brady was beset by financial difficulties to such an extent that he for some time lived in a closed-in belfry. In 1849 his health failed, and he was given Dom Serra as coadjutor. This dual administration of Spanish and Irish ecclesiastics led, unfortunately, to strained relations between them, which were further complicated by financial difficulties, and in 1850 Dr. Brady visited Rome to find some way out of the confused situation which had resulted. In October 1851, after the bishop had returned to the colony, Pius IX suspended him from his functions. In August 1852 he left Western Australia and went to Rome, eventually settling at Kilmore in Ireland; but he never resigned his see, and was still bishop of Perth when he died in France on 2 December 1871. While in Rome in 1845 he published a short *Descriptive Vocabulary of the Native Language of West Australia.*

E.M.O'B.

Bragg, SIR WILLIAM HENRY, born at Wigton in Cumberland, England, on 2 July 1862 and educated at King William's College in the Isle of Man and at Trinity College, Cambridge (B.A., 1884; M.A., 1887; honorary fellow of his college), was in 1885 appointed Elder professor of mathematics at the university of Adelaide. In 1895 he was elected to the council of the South Australian school of mines, and in 1898 to the council of the university. In 1907 his work

on radio-activity gained him a fellowship of the Royal Society, and in 1908 he left Adelaide to become Cavendish professor of mathematics at the university of Leeds. Thence in 1915 he went to London as Quain professor of physics at the university of London, and in 1923 became Fullerian professor of chemistry at the Royal Institution, director of the institution, and director of the Davy-Faraday research laboratory. His chief interest in all these positions has been the investigation of radio-active substances and phenomena. For his work he has received numerous honours, including the D.Sc. degree of Manchester (1914), Leeds (1919), and Trinity College, Dublin (1920); the Rumford medal of the Royal Society; and the membership of learned societies in France, Italy, Holland and Denmark. In conjunction with his son, W. L. Bragg, he has also received the Nobel prize (1915), the Barnard gold medal of Columbia university in the United States, and the gold medal of the Société Italiana della Scienze. He has published many papers in the *Philosophical Magazine*, the *Transactions* of the Royal Society, and similar periodicals, and in 1924 published *Concerning the Nature of Things*, founded on a series of lectures given at the Royal Institution. (C.B.E., 1917; K.B.E., 1920.)—His son, WILLIAM LAWRENCE BRAGG, born at Adelaide on 31 March 1890 and educated at St. Peter's College, Adelaide, the university of Adelaide (B.A., 1908), and Trinity College, Cambridge (M.A., 1912), in September 1919 succeeded Sir Ernest Rutherford as Langworthy professor of physics in the university of Manchester. Honours obtained in conjunction with his father are mentioned above. During the war he served in France as technical adviser on sound-ranging (1915-9), and was awarded the military cross and the O.B.E.

Brassey, THOMAS, 1st Earl Brassey (1836-1918), eldest son of Thomas Brassey a well-known railway contractor, was born on 11 February 1836, educated at Rugby and Oxford (B.A., 1859; M.A., 1862; hon. D.C.L., 1888), and trained for the law, but soon divided his time between yachting, politics, and the normal life of a country gentleman. He sat in parliament as member for Devonport in 1865, and represented Hastings from 1868 to 1885, taking especial interest in naval matters and being a civil lord of the admiralty in 1880-4 and parliamentary secretary in 1885. The main story of his life is of purely English interest; but on 25 October 1895 he became governor of Victoria, and held the position till 31 March 1900. His term of office was on the whole uneventful, as Victoria was recovering slowly from the financial crisis of 1892-3. He is best-known as the master of the yacht *Sunbeam*, in which he voyaged over 300,000 miles, and as the founder of the *Naval Annual*, which his son the 2nd earl edited from 1890 to his death. In 1886 Brassey was raised to the peerage as Baron Brassey, and in 1911 was made an earl. He died on 23 February 1918; his son dying on 12 November 1919, the peerage became extinct. (K.C.B., 1881.)

Bray, SIR JOHN COX (1842-1894), son of T. C. Bray, was born in Adelaide on 31 May 1842, educated at St. Peter's College and privately in England, and trained for the law. Admitted to the South Australian bar in 1870, he entered parliament in 1871 as member for East Adelaide, and sat for that constituency continuously until his resignation in 1892. He soon took a prominent place in the house, becoming minister for justice in the Blyth ministry (March-June 1875), attorney-general in the Colton ministry (June 1876-October 1877), leader of the opposition from that year to 1881, and premier from 1881 to 1884. In 1885 he joined the Downer ministry as chief secretary, and later as treasurer (1886-7); in 1888 he was elected speaker, but resigned in 1890 to become chief secretary in the Playford ministry, and left politics altogether in 1892 to take up the colony's agent-generalship in London. Illness compelled him to resign this in 1894, and his death at sea followed almost immediately on 13 June in that year. In his 21 years of political life (eight of them spent in office) there is little of actual achievement to consider. But he took much interest in federation, represented his colony in the intercolonial conference of 1883, presided over the Australian Natives' Association conference of 1890 which declared for federation, and was one of the South Australian representatives at the convention of 1891. (K.C.M.G., 1890.)

Bread. Bread made in Australia differs from that made in Europe (*a*) because the method of baking is different, (*b*) because the flours used are of a different quality. The European (ferment) system of bread-making consists in mixing a certain amount of flour with yeast, allowing the yeast to work for a while, and then adding the rest of the flour and water. In the Australian (straight) system, which is quicker and involves less handling, the flour and water are mixed first, and yeast and a little salt added; the mixing is done with machines, some of which can take 1000 lb. at a time. After mixing, the dough is turned into a trough to ripen and rise; thence it goes to a hopper, and thence to a dividing machine, in which it is cut into pieces weighing slightly more than 4 lb. (for a whole loaf) or 2 lb. (for a half loaf), since weight is lost in baking. The difference in quality is more important. Any wheaten flour makes a dough that is sticky and elastic, so that it will hold, and be inflated by, the gas from fermentation; but some wheats produce stickier flour than others, so that they 'rise' better, hold more water, and make a larger loaf from the same quantity of flour. These are called 'strong' flours. Australian wheats, thanks to W. J. Farrer (q.v.), yield a flour stronger than any others except those grown in Manitoba.

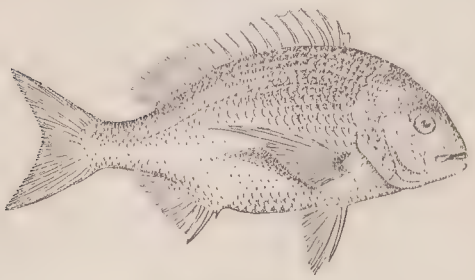
Of late years practical research into the science of bread-making has been carried on by Professor H. G. Chapman of the university of Sydney, aided by the Commonwealth advisory council of science and industry, and by the government of New South Wales, which built him a bakehouse at the Sydney technical college. Here bread has been regularly produced three times a week since 1916, the whole process being completed between the hours of 9 a.m. and 6 p.m. under simple but exact conditions of weight and temperature. Every dough is made with 250 lb. of flour, and consistently yielded 174 2lb. loaves, i.e. 1392 loaves to the ton of flour, or 104 to the bag. The weight of the bread, 15 hours after baking, averaged 354 lb.—6 lb. over the legal weight. The yeast was carefully made of uniform strength, and simple bacteriological methods ensured purity and freedom from acids.

H.G.C.

Bream, a vernacular name applied by fishermen of widely different fishes that have nothing

in common beyond a very superficial resemblance. The true bream of Europe is a freshwater fish of the carp family (Cyprinidae), but in Australia the name is generally applied to marine fishes of the family Sparidae.

The Black Bream (*Sparus australis*) is one



Black Bream.

of the best-known and most prized of all fishes occurring on coasts south of the tropics. It occasionally attains a weight of seven pounds, but is usually much smaller. It is an excellent food-fish, and is marketed in enormous quantities throughout the year, being secured by net-fishermen in estuaries and inlets. It also affords great sport to anglers, and its reputation as a game fish is such that trophies for its capture under various conditions are awarded by all fishermen's associations. This fish and an allied species, the Tarwhine (*S. sarba*), are also known as silver bream. The tarwhine is very widely distributed throughout the Indo-Pacific region, and extends southward as far as Port Jackson; it has a less pointed snout than the black bream, and has yellowish stripes along each row of scales on the sides. Another tropical species of similarly wide range, the Pikey Bream (*S. latus*), is so named on account of a long and strong spine in the anal fin; it occurs on the coasts of the northern half of Australia, together with lesser known relatives. The Tasmanian 'black bream' is a blackfish, q.v. See also BLACKFISH, BONY BREAM, DRUMMER, EMPEROR BREAM, SNAPPER, TREVALLY. A.R.McC.

Bremer, SIR JAMES JOHN GORDON (1786-1850), scion of a naval family, was in accordance with the custom of the times entered as a first-class volunteer in the Nore guardship when only eight years old, joined the naval college at Portsmouth when 11, and five years later was appointed to H.M.S. *Endymion*. For the next 20 years he served efficiently but unobtrusively in various oceans (lieutenant, 1805; commander, 1807; captain, 1814; rear-admiral, 1849). When P. P. King (q.v.) in 1823 proposed that the British government should make a settlement on the northern coast of Australia, Bathurst sent Bremer in H.M.S. *Tamar* to take formal possession of the strip of coast and islands between 130° and 135° E. The assigned reasons are worth noting: they were (*a*) to provide a commercial base for English merchants trading with the Dutch islands, (*b*) to provide a naval base from which the trade of the East India Company and of private merchants with China could be protected against hostile attacks. If, however, some other Power had already seized the region, Bremer was to accept the fact and make a settlement eastwards on the Liverpool River. In those days, evidently, it was not intended that Britain should claim the whole of Australia. Leaving Port Jackson on 24 August 1824, Bremer took possession of the mainland at Port Essington on 20 September, and of Melville and Bathurst Islands on the 26th, planting the settlement on Port Cockburn in the first-named island. For the later history of this settlement see NORTHERN TERRITORY. Bremer's next connection with Australia—he had meanwhile taken part in the Burmese war—was in 1837, when, the Melville Island settlement having been abandoned, he was sent in H.M.S. *Alligator* to make a new one at Port Essington. On this occasion the occupation was deliberately intended to anticipate the French; the earlier reasons had been cancelled by the establishment of a colony on the Swan River. Leaving Port Jackson on 18 September 1838, Bremer reached Port Essington at the end of October, found a good water-supply—the lack of one had been his main reason for not settling there in 1824—and waxed enthusiastic about the fertility of the surrounding region. In the following June he took the *Alligator* back to Port Jackson for supplies: but Gipps, who on 22 July received news of trouble in China, suggested that he should proceed thither at once with the warships then in the harbour. Bremer despatched two, and was preparing to follow in the *Alligator* when news arrived of a serious mutiny among the troops stationed on Norfolk Island. The *Alligator* was therefore diverted to the Island, taking a detachment of another regiment to quell the mutiny; and when Bremer returned the news from China was so reassuring that Gipps thought it unnecessary to send him there, and so allowed him to return early in November to Port Essington. In December, however, he was summoned to India to take over the naval command in those waters, and in 1840-1 commanded a naval expedition to China; then he returned to England, held several important posts in home waters, was made rear-admiral in September 1849, and died on 14 February 1850. (C.B., 1815; K.C.H., 1836; K.C.B., 1841.)

Brennan, LOUIS, born at Castlebar in Ireland on 28 January 1852, educated in Melbourne (where his parents settled in 1862) and trained for civil engineering, in 1874 conceived the idea of a new type of torpedo and spent several years in reducing it to a practical form. The Victorian government gave him £700 towards the expense of experimenting. Sir Andrew Clarke (then inspector-general of fortifications in England) urged the British authorities to adopt it for the defence of harbours and narrow channels, and in 1887 the Imperial government purchased the perfected torpedo for £110,000 and engaged Brennan to superintend the manufacture. In 1896 his position was altered to that of consulting engineer to the factory. About 1907 he was led by his study of the use of gyroscopes in torpedoes to devise a monorail system of traffic in which the vehicles are kept upright on the single rail by the action of a large gyrostat within them. During the war Brennan was attached to the munitions inventions department of the ministry of munitions for confidential research work on aircraft, and has continued his experiments since 1919 under the air ministry. In June 1922 it was announced that a helicopter invented by him had risen to a height of 2000 feet under its own power, carrying a pilot and fuel for an hour's flight; had hovered stationary for half an hour in a 20-mile wind, and then descended vertically with the engine cut out; and had developed a horizontal speed of 60 miles an hour. (C.B., 1892.)

Brewing. See MANUFACTURES.

Bridges, SIR WILLIAM THROSBY (1861-1915), born at Greenock in Scotland on 18 February 1861, and educated at the royal naval school at Greenwich and the Canadian military college at Kingston, came to Sydney after graduation in 1883 and entered the New South Wales roads and bridges department. He volunteered unsuccessfully for the Sudan contingent, but later in 1885 obtained a commission in the colony's permanent artillery (lieutenant, 1885; captain, 1890; major, 1895; lieutenant-colonel, 1902; colonel, 1906; brigadier-general, 1910; major-general, 1914) and was put in charge of the forts on Middle Head, Port Jackson. There in 1893 a school of gunnery was established, and Bridges made chief instructor. Volunteering in 1899 for the South African war, he was attached as major to the artillery of the cavalry division, and saw the relief of Kimberley and the fight at Paardeberg. Invalided home with typhoid, he in 1903 joined the federal headquarters staff as assistant quartermaster-general, and in 1904 acted as deputy adjutant-general and chief staff officer. He had long since gained a reputation for hard work and erudition, and when in the reorganization of the federal defence forces a chief of intelligence was needed (1905-8), or an Australian representative on the Imperial general staff in London (1909-10), Bridges was the obvious man for the work. He returned from London in 1910 to create the military college at Duntroon, and in 1914 succeeded General Kirkpatrick as inspector-general of the Australian military forces.

At the outbreak of the war in 1914 he was entrusted by the Commonwealth government with the organization of an expeditionary force that had been offered for oversea service on 3 August. At once he took a decision of vital importance. The British authorities had suggested a force organized in brigades, such as might be split up among the existing divisions of the British army; Bridges persuaded the Australian minister to offer a complete Australian division, and to hint that its organization had already begun. It was this form of offer, and this only, that made it possible to keep together the Australian troops as a separate entity, destined later on to grow into an army. Expecting to be given command of the troops left in Australia, as was provided in the defence scheme, Bridges recommended that the command of the oversea contingent should be offered to Sir Edward Hutton; but the government decided without hesitation that he himself should take it, and by him it was created, administered, brought into its first campaign, and even named—for the name 'Australian Imperial Force,' perpetuated as 'A.I.F.,' was of his own devising.

The rest of his life was part of A.I.F. history. He took the force to Egypt, trained it there, took it on to Lemnos, planned (in consultation with General Birdwood) the landing, was ashore before 8 a.m. on the memorable 25th of April, being for that day in charge of the two divisions employed at Anzac—the First Australian and the New Zealand and Australian. On 15 May he was mortally wounded by a sniper, and died in the hospital ship on the 19th.

Bridges was not a popular commander, or one who willingly came into contact with his men. But he was a great organizer and administrator in peace and in war, and his remarkable driving power was directed by a no less remarkable intellect, fed with constant study both of books and of men. On his tomb, which tops a hill overlooking the college at Duntroon, the inscription runs:—'A gallant and erudite soldier.' (C.M.G., 1909; K.C.B., 1915.)

Brierly, SIR OSWALD WALTERS (1817-1894), born at Chester in England on 19 May 1817 and grounded in art by Henry Sass (who also trained Millais, Cope, and Frith), studied naval architecture at Plymouth, had two paintings in the Royal Academy of 1839, and in 1841 joined Benjamin Boyd (q.v.) in a cruise to Australia in the *Wanderer,* which left Plymouth on 23 December 1841 and reached Sydney on 18 July 1842. Settling for a time at Boyd Town on Twofold Bay, Brierly acted as manager for Boyd's whaling enterprises. The Melbourne press attributed a large catch of whales in 1845 to his 'superior management.' (The statement in the *Dictionary of National Biography* that he 'settled in Auckland' is a mistake due to the fact that Twofold Bay is in Auckland county, N.S.W.). In 1848 Owen Stanley, then captain of H.M.S. *Rattlesnake,* invited Brierly to accompany him on a voyage of survey N. and NE. of Australia (T. H. Huxley was another passenger); the results of this and a second voyage were some excellent sketches and valuable notes of the places visited, a spirited painting (in crayons and distemper) of the *Rattlesnake* in a squall off Timor, and Brierly's name given to an islet in the Louisiade group—which is now usually called Dadda Hai Island. These trips unsettled Brierly, and as he could not bring himself to return to Boyd Town, he welcomed the offer of Henry Keppel in 1850 to take another cruise among the Pacific islands, joined him in H.M.S. *Maeander,* and in her returned to England in July 1851.

Keppel's friendship made Brierly. He was his guest in the *Maeander* during the Baltic campaign of the Crimean war (1854) and again in the Black Sea (1855), and thus came under the notice of Queen Victoria, who commissioned him to sketch from the royal yacht the naval review which was held at the end of the war. From that time he enjoyed much royal favour; he accompanied the Duke of Edinburgh to Norway in 1863 and round the world in 1867-8—revisiting Australia on that occasion—and on his return was attached to the suite of the Prince of Wales during a tour in the eastern Mediterranean. In 1874 he was appointed marine painter to the Queen and to the Royal Yacht Squadron, and in 1881 curator of the Painted Hall, Greenwich. He died in London on 14 December 1894.

Although praised by Ruskin for his 'faithful and brilliant' drawings, Brierly's work is more valuable as a record than as art. The art gallery of New South Wales has his 'South Sea Whaling off Twofold Bay;' his 'H.M.S. *Galatea* Entering the Heads' is in the possession of the Fairfax family; and there are several in the Mitchell library, Sydney, one of them ('H.M.S. *Black Prince* in a Gale') being probably the best he ever painted. (Kt. Bach., 1885.)

Brigalow. See ACACIA.

Brisbane, capital of the State of Queensland, lies in 27° 28′ S. lat., 153° 2′ E. long., on the Brisbane River, about 12 miles as the crow flies from its mouth in Moreton Bay. The discovery of the river is narrated under EXPLORATION BY LAND. Oxley, who first explored it in 1823 while seeking a site for a new penal

settlement, recommended that a temporary depot should be established at Redcliffe Point (Humpybong) and a permanent township located later on Sea Reach. Accordingly in September 1824 Oxley and Hoddle, with Lieutenant Miller of the 40th regiment, a detachment of his regiment, and a working party of convicts, made a depot at Humpybong. Renewing his examination of the river, Oxley on the 28th landed where is now North Quay and reckoned the place 'a not ineligible site for a settlement:' and, when Governor Brisbane in December brought up Forbes, the chief justice, to inspect the new territory, Oxley's second choice was confirmed, and named Edenglassie by Forbes. This name, however, did not stand. As early as 1825 hospital records use the name 'Brisbane' for the little township, and Darling in 1827 wrote of it as 'Brisbane Town,' but definite official confirmation of the name is lacking until 1839.

Governor Brisbane, eager to relieve Port Macquarie of its convicts, sought at once to establish a regular penal settlement at Edenglassie, but the colonial office was more far-seeing and withheld permission for some time, so that the official proclamation was not made until 15 August 1826. Meanwhile, however, both Brisbane and Darling sent convicts up to erect the necessary buildings and exploit the natural resources of the neighbourhood, Patrick Logan (q.v.), commandant in 1826-30, being especially active in this regard. Darling disliked the site because of the 'tediousness and difficulty of the access,' and in 1827 proposed to make a new settlement on Stradbroke Island, at Dunwich. In 1829 he revived this proposal on the ground that the water-supply at Brisbane was poor and tainted; as an alternative he suggested moving the establishment about six miles downstream, but only the farm was actually so moved. When the penal settlement was officially constituted, 'colonially convicted' prisoners were sent to it—i.e. those who, having been originally transported from England, had committed fresh crimes within the colony—and Port Macquarie was slowly emptied of its convicts. As the Darling Downs began to fill up with squatters' runs, the convict depot was defined by a circle of 50 miles' radius round Brisbane, and entrance from the tableland was strictly prohibited. In 1836 James Backhouse describes Brisbane as consisting entirely of buildings for military or convict use. Relics of those days still exist—the observatory, which was in the thirties a windmill, and the colonial stores building, which dates from 1829. In 1839 measures were taken for the gradual withdrawal of the prisoners; the opening of the district to free settlement was delayed, however, until the receipt, early in 1842, of instructions from England concerning the conditions of land-sales and the application of the money to be derived therefrom. The first landsale in Brisbane was held on 14 July 1842. Captain Wickham, R.N., was appointed the first civil magistrate. But the squatters, now admitted to the Moreton Bay enclave, revived Darling's objection to Brisbane as a port, and demanded a new deep-sea port at Cleveland: Gipps, however, decided to retain the old site, and Brisbane was at last safe. That was a time of commercial optimism, accompanied with much land speculation, and in 1843 town allotments realized up to £250 an acre: in the same year the Hunter River Steam Navigation Company established regular communication between Sydney and Brisbane, a mine being opened near Ipswich to supply their vessels with coal. An area of about 60 miles square, with Brisbane near its eastern side, was proclaimed the county of Stanley and joined with the two nearest coastal counties (Macquarie and Gloucester) to return a member to the New South Wales legislative council. From 1844 onwards there followed a period of depression, due largely to the superior attractions of Port Phillip and the marked neglect of Brisbane by the squatters of the tableland; in 1846 the whole county could only muster 1599 inhabitants. Still, it was in 1846 (on 20 June) that the *Moreton Bay Courier* (now the *Brisbane Courier)* was first issued.

It was at this time that John Dunmore Lang (q.v.) took a hand in remoulding the Moreton Bay settlement. While the Downs squatters were extending their runs towards the coast, and in 1847 obtained an order-in-council declaring all lands 'unsettled' except those within three miles of the coast or ten miles of Ipswich, Lang was in London besieging the colonial office with proposals for a 'Moreton Bay Cotton Company' and a 'Cooksland Colonization Company' to people the land round Brisbane with agriculturists. Finally in 1849, despite the opposition of the colonial office and the total lack of legal authority, he selected about 600 'virtuous Presbyterians' in Scotland and sent them out in three chartered vessels, the *Fortitude* (after which Fortitude Valley is named), the *Chaseley*, and the *Lima*. Cotton, which in his opinion offered the best opportunity for closer settlement, was to be the chief product of these new settlers; but the local administration warned them off as intruders, and the land orders which Lang had provided were found worthless, so that the experiment as its inventor conceived it proved a failure. Still, the arrival in the small settlement of so many industrious and capable Scots certainly accelerated the progress of the district, and by 1851 the population of the county had increased to 8575. In that year the Stanley Boroughs (Brisbane, South Brisbane, Kangaroo Point, and Ipswich) were constituted an electorate for the New South Wales legislative council. On 6 September 1859 Brisbane was incorporated, and the first municipal elections were held on 13 October; late in the year the town became the seat of government of the new colony of Queensland. An old residence built by Andrew Petrie (who arrived in Brisbane in 1837 as engineer and clerk of works) for Dr. Hobbs, one of the Scots selected by Lang, was taken over for the first governor, Sir George Bowen, until a government house was ready in 1862. The old convict barracks, which had been converted into supreme court buildings, were occupied temporarily by the legislature.

Metropolitan improvements followed incorporation. In 1864 work was begun on the Enoggera reservoir at Ithaca Creek to improve the water-supply, which had so far been drawn from a chain of waterholes and sold to the residents by licensed carriers. Work was also begun in 1864 on the Victoria bridge and the town hall. In 1873 the Brisbane-Ipswich railway was commenced, Brisbane being thus linked up with the railway system of the colony, which had previously terminated at Ipswich. The tramways, which were altered from horse to electric power in 1896, were operated by a private company until 31 December 1922 when they were purchased by the Queensland government; the total length of the system when taken over was 42.6 route-miles.

Progress in the arts and education kept pace with industrial development. The Brisbane school of arts, opened in 1851, was used for musical and theatrical productions as well as for public meetings until a permanent theatre was built. The Brisbane grammar school was founded in 1869; in 1871 the Queensland museum was opened; the national art gallery was founded in 1895; the Brisbane library (later the public library of Queensland) was established as a public library in 1896; and in 1909 the university of Queensland was founded. For the formation of a 'Greater Brisbane' controlled by a single municipal council see LOCAL GOVERNMENT.

The population of Brisbane on 31 December 1923 was 235,687, constituting over 29 per cent of the total population of Queensland. G.H.-P.

Brisbane, SIR THOMAS MAKDOUGALL (1773-1860), born at Largs in Ayrshire on 23 July 1773 and educated at the university of Edinburgh, entered the army in 1789 (ensign, 1789; lieutenant, 1792; captain, 1793; major, 1795; lieutenant-colonel, 1800; colonel, 1810; major-general, 1813; lieutenant-general, 1825; general, 1841), and saw service in Flanders (1793-5) and the West Indies (1795-8). But a tropical climate did not suit his health, and, though he served in the West Indies a second time (in 1800-3), he went on half-pay when his regiment was ordered to India in 1805, and retired to Ayrshire to study astronomy. In 1810, however, he was made assistant-adjutant-general, and in 1812 Wellington summoned him to the Peninsula, where he commanded a brigade in Picton's division and saw the series of battles from Vitoria to Toulouse. Having proved himself a sound commander, he was next sent to Canada with his brigade, and took part in the unfortunate fight at Plattsburgh on Lake Champlain; he thus missed Waterloo, but was given a brigade (and afterwards a division) in the British army of occupation in France. In 1818 he returned to Scotland and resumed his scientific studies, but in 1820 was chosen by Bathurst, on the recommendation of Wellington (and apparently of Joseph Banks), to succeed Macquarie as governor of New South Wales. His commission was dated 3 February 1821, and he reached Sydney on 7 November following.

Brisbane's career as governor cannot be called a success. He would have made an excellent governor of a modern self-governing colony; but for a crown colony—especially for one rent with disputes between 'exclusive' and emancipist, and about to enjoy a slight measure of freedom after years of autocracy—he was too peace-loving, too apt to rely on subordinates, too much of an onlooker. Dr. Lang described him as 'a man of the best intentions, but disinclined to business and deficient in energy.' The chief reforms introduced during his term —and they were of great importance—originated either from Bigge's report or from the act (4 Geo. IV cap. 96) which created a constitution for the colony. His own intended reforms were as a rule well designed and useful, but came to little because he could not or would not prevent his officials from thwarting them. Probably the most effective was the limitation of land grants, both in area and by the provision that grantees must employ and maintain one convict for each 100 acres. He also systematized the convict administration, and made it pay by hiring out gangs to settlers for clearing land; abolished censorship of the press (in 1824); reformed the currency, cut down the expense of the commissariat, and made the government farms pay. In accordance with Bigge's reports he made multitudinous changes (he gives in one despatch a list of 157 suggestions that had been carried out), the most valuable of which concerned the segregation of different classes of convicts, educated convicts of good behaviour being usually sent to Bathurst, and the twice-convicted to special penal stations. From this provision, in particular, sprang an activity in coastal exploration that resulted in the discovery of the Brisbane River; the journeys of Hume and Hovell to Port Phillip and of Allan Cunningham to Pandora's Pass also distinguished Brisbane's governorship. Of the constitution which he inaugurated an account is given under CONSTITUTIONS; its essence was that the colony was to be considered no longer a convict settlement, but a colony of free men to be developed by convict labour—as had been Virginia and other early American colonies of Britain. The governor, therefore, while still the final arbiter, was given a consultative council of nominees; if he chose to disregard their advice, he must at once report the matter to London. A supreme court was also set up, and trial by jury allowed in certain cases. The whole system was obviously provisional, and foreshadowed a grant of greater freedom as soon as the settlers had proved themselves fit for it. Immigration was encouraged, especially of young settlers with money, who either developed the districts round Bathurst, Maitland, Goulburn, and Campbelltown, or pioneered the industry later known as 'squatting' by travelling sheep and cattle into the waste lands farther out. As a result the population of the colony increased in 1820-5 from 33,500 to 52,500, though convicts were arriving at the rate of only 1500 a year.

Nearly all Brisbane's measures, original or suggested, were (as has already been said) tainted with the maladministration of his subordinates. Even the notable explorers of his term suffered; Oxley as an 'exclusive' was able to disparage the achievement of Hume and Hovell. The greatest offender, however, was Frederick Goulburn (q.v.), who used to alter the governor's orders and issue others on his own authority, put words into Brisbane's mouth (see PRESBYTERIAN CHURCH), and do many other things that embroiled both himself and the governor with colonists and the colonial office. In 1824 Bathurst settled the trouble by recalling them both. Brisbane left Sydney on 1 December 1825—having prolonged his stay to the utmost in the hope of being able to carry on until Darling arrived. In 1836 he was offered (probably by Wellington) the command in North America, but refused it, and devoted the rest of his life to science, philosophy and agriculture. He died on 27 January 1860 in the room in which he had been born.

Brisbane's astronomical achievements were probably greater than his political doings, and brought him greater notoriety. His observatory at Largs was one of the only two in Scotland; in the Peninsula Wellington declared that he 'kept the time of the army;' when he was first suggested to Bathurst for the New South Wales governorship, Bathurst retorted that he wanted 'a man to govern the earth, not the heavens.' His establishment of the observatory at Parramatta is narrated under ASTRONOMY; for the work done in it Herschel called him 'the founder of Australian science.' Oxford in 1832. Cam-

bridge in 1833, and Edinburgh in 1824 conferred honorary degrees on him; he joined the Royal Society of London in 1810, that of Edinburgh in 1811 (president, 1833-60, succeeding Sir Walter Scott), and the Astronomical Society (vice-president, 1827). (K.C.B., 1814; K.C.H., 1817; baronet, 1836; G.C.B., 1837.)

His cousin, Commodore Sir James Brisbane (1774-1826), was connected with Australia only by his death. During a distinguished career he was Howe's signal midshipman on the 'glorious 1st of June,' 1794, saw the capture of Cape Town in 1795, served under Nelson at Copenhagen in 1801, blockaded the Ionian Islands in 1808, took part in the expedition against Algiers in 1816, and in 1825 (as commander-in-chief on the East Indies station) conducted the naval operations against Rangoon. Leaving Trincomalee on 26 August 1826 in H.M.S. *Warspite*, to take the command on the South American station, he reached Port Jackson on 19 October in a state of great exhaustion, was taken ashore, and died at government house on 19 December. Darling gave him a state funeral. (The statement in the *Dictionary of National Biography* that he died at Penang is an error.)

Bristle-birds and Grass-wrens, dull-coloured perching-birds with long tails that are usually carried erect, belonging to the genera *Sphenura, Diaphorillas* and *Magnamytis*, peculiar to Australia. They are generally regarded as members of the family of warblers (Sylviidae) and are probably near relatives of the Australian wrens (*Malurus*)—perhaps also of the field-wrens (*Calamanthus*), ground-wrens (*Hylacola*) and scrub-wrens (*Sericornis*) but they are a good deal larger than any of these forms. Both

Eastern Bristle-bird.

bristle-birds and grass-wrens are shy birds, frequenting dense thickets, keeping under cover, and darting rapidly across the open spaces between bushes with their tails over their backs. Their nests are dome-shaped structures, composed of grass, with the entrance at the side; they lay two or three eggs, white with brown or reddish spots.

The bristle-birds (*Sphenura*) derive their name from the three pairs of stout bristles that spring from the base of the beak and curve backwards. The Eastern Bristle-bird (*S. brachyptera*) is found—in coastal areas only—in New South Wales and eastern Victoria, and the Western Bristle-bird (*S. longirostris*) in the southern districts of Western Australia. The Rufous Bristle-bird (*S. broadbenti*) occurs on the coastal ranges from Cape Otway in Victoria, to Mount Lofty in South Australia, and also near Cape Geographe, Western Australia. The ten species of grass-wren (*Diaphorillas* and *Magnamytis*) are all confined to the interior, or to the arid regions of the north-west coast. W.B.A.

Bristle-tails. See Thysanura.

Bristle-worms, vernacular name of the Chactopoda, a division of the phylum Annelida —the segmented worms (see Worms). The division comprises the earthworms (q.v.), a number of small worms that live in fresh water, and a vast multitude that live in the sea—for the most part about tidal limits. These last belong almost exclusively to the sub-class Polychaeta (many-bristled worms), as contrasted with the sub-class Oligochaeta (few-bristled worms) which comprises the earthworms and their allies. The Polychaeta include among their numerous Australian representatives a good many conspicuous and familiar objects of the seashore. One of them, found on all extra-tropical coasts where there are tidal rocks, forms thick encrustations of a whitish shelly substance, fully laid bare at low tide. Examined closely, these are found to be composed of twisted calcareous tubes, open at one end, and each lodging a little bristle-worm (*Galeolaria caespitosa*), about an inch or so in length. When out of the water the worms withdraw completely into their tube, the opening being closed with a plug that is armed with spines; when the tide again covers them, each thrusts out the head-end of the body, with the stopper and a crown of plume-like gills.

Besides this widespread, rock-encrusting form (which is also abundant on piles and other submerged timbers), there are many other kinds of tube-dwelling bristle-worms, sometimes growing in masses, sometimes in more isolated fashion, their tubes composed sometimes of hard shelly material like those of *Galeolaria*, sometimes of a flexible membranous substance reinforced with mud or sand, or fragments of broken shells. But these differ little from the corresponding forms in other parts of the world; and no genera are known peculiar to, or specially characteristic of, Australian seas.

The same holds good of the very numerous bristle-worms that are not confined to tubes, but burrow in mud or sand, or creep about among seaweeds and other marine growths. The genera, and sometimes the species, are identical with those occurring in other regions.

Sea-fishermen all over the world use certain species of bristle-worm as bait. In Great Britain, in European countries generally, and in North America the worms mainly used for this purpose are species of *Arenicola*—the 'lug-worms' of Great Britain, which are found burrowing in sand; species of *Arenicola* occur in Australia also—mainly in the south and south-west, and in Tasmania. But on the east coast

the worms used for bait belong to an entirely different group—the family Eunicidae, characterized by the possession of a formidable array of horny jaws. The commonest are species of *Marphysa* (probably *M. novae-hollandiae* of Kinberg) and of *Onuphis* (*O. teres* of Ehlers), large worms, which burrow deeply in the sand about low-water mark. *O. teres* is lured to emerge partly from its burrow with the bait of a piece of meat.

The most important contributions to our knowledge of Australian marine bristle-worms on the systematic side are Augener's two papers in *Die Fauna Südwest Australiens*, vols. IV. and V. (Jena, 1913, 1914). W.A.H.

Brittle Bladder-fern. See FERNS.

Broken Bay, an arm of the sea which forms the estuary of the Hawkesbury River on the coast of New South Wales; near the mouth it has two branches, the long and narrow Pitt Water to the south, and to the north Brisbane Water, with a narrower and shallower entrance but expanding into a broad bay. The bay and its branches were discovered on 2 March 1788 by Phillip, who described Pitt Water as 'the finest piece of water I ever saw.' On that occasion he did not find out that he was entering an estuary: it was only on 10 June 1789 that he penetrated beyond Lion Island, and only on the 12th that he knew he was rowing up a river.

At half-past-five in the afternoon of 7 May 1770 Cook noted in his log 'some broken land like a bay N. 40° W.,' and it was in search of this that Phillip lighted upon Broken Bay and so named it. The difficulty is that Phillip was looking for a bay 'about eight miles to the northward of Port Jackson,' while the mouth of Broken Bay is nearly twice as far north. Phillip did not comment on this discrepancy, but Flinders in his *Voyage to Terra Australis* (ii. 2) called attention to it, and suggested that Cook's 'broken land' was in the neighbourhood of Narrabeen lagoon. (Flinders as usual took his Cook quotations from Hawkesworth—not always a safe authority.) Now the position stated in the log—a bearing of N. 40° W. at a moment when the *Endeavour* was about 8 miles off shore and 9½ miles north of Port Jackson—coincides with that of Barranjuey Head at the mouth of Broken Bay; but Cook's chart, for reasons unknown, shows the name 'Broken Bay' quite six miles to the south, near Narrabeen lagoon. The chart and Hawkesworth cannot be reconciled with the log—and there the matter rests. F.J.B.

Broken Hill, an important mining city in Yancowinna county, New South Wales, situated in the Barrier Ranges about 1000 feet above sea-level, and 35 miles from the South Australian border. Commercially and geographically it is closely associated with South Australia, being connected by rail with Port Pirie (which is its natural port, and where large smelters have been erected) 254 miles away, and with Adelaide, 335 miles away. Direct railway connection with Sydney is under construction; this line will be 703 miles in length. The climate of Broken Hill is arid; its average annual rainfall is about 9 inches, and the annual evaporation about 7ft. 6in. Heavy dust-storms are common. The summer shade temperature frequently passes 100° Fahr., and 112° and 115° have been reached. In winter it is cool, and frosts are experienced. The mean temperature is 65.5°. For a few miles round the town the vegetation was cleared off by residents in the early mining days, and has not regrown—except for certain grasses and herbs which appear for a short time after rain. The original hills were covered with mulga scrub, and the flats grow mainly bluebush and annual saltbush. The creeks, which at ordinary times are beds of sand, are generally marked with a line of gum-trees on each bank.

Early History.—The Barrier Ranges, which have a summit level of about 1400 feet, were discovered by Sturt in 1844. They consist of ancient contorted sedimentary rocks, intruded by granite, diorite, etc., and are traversed by numerous white quartz reefs. In 1867 reports of these conspicuous outcrops caused a rush from South Australia in search of gold. It ended in disaster, the prospectors encountering great difficulties from lack of water without discovering gold; other minerals were not looked for, and the rich deposits of silver ore were unrecognized. The first recorded discovery of silver-lead ore was made in 1876 by P. Green at Thackaringa, 20 miles from Broken Hill. From his mine 36 tons of ore were carted 210 miles to Burra Burra, railed to Adelaide, and shipped to England—to be jettisoned on the voyage. In 1880 another lot was shipped from the same mine, and reached England safely. In 1882 a rush was made to Thackaringa and Umberumberka, and a number of mining leases were taken up. In 1883 the township of Silverton was surveyed, over 5000 acres were applied for as mining leases, and small quantities of extraordinarily rich silver ore were obtained from a number of shallow narrow lodes. They consisted mainly of chloride of silver, and assayed in some cases as high as 10,000 (even 18,000) oz. of silver to the ton. Larger lodes of silver-lead ores (mainly galena), but of lower values, were also worked in the Umberumberka, Pinnacles, Daydream, Thackaringa, and other mines. In September 1883 a boundary rider named Charles Rasp, employed on Mount Gipps station, pegged out 40 acres of great iron-stone outcrop as a tin mine. A syndicate of seven, each of whom contributed £70, was then formed, including George McCulloch, manager of the station, and six more blocks of 40 acres were applied for. This syndicate was generally laughed at, but it persevered and sunk a shaft called 'Rasp's shaft' in which, towards the end of 1884, chloride of silver was struck at a depth of about 100 feet. Rich ore was discovered on other parts of the property soon after, and on 10 August 1885 the Broken Hill Proprietary Co. was floated. No tin was found. Two or three years later the Block 10, Block 14, and British Companies were floated off the parent company, which only retained three of the original seven blocks. Other companies were formed to N. and S., the main ore bodies, as since developed, extending over a distance of about three miles.

In 1885 blast furnaces were erected at the Pinnacles and Daydream mines, and in 1886 at Broken Hill. In 1887 the Silverton Tramway Co. opened a railway line from Broken Hill through Silverton to Cockburn, where it junctioned with the South Australian railways. Silverton now began to decline rapidly in favour of Broken Hill (named by the government Willyama). The town grew by leaps and bounds, and in 1889 its population reached 17,000. The rapidity of growth is perhaps best shown by the value of its yearly mineral output, which in 1885 was £108,281, in 1888 £1,001,848, and in 1891 £3,529,043.

Modern Development.—The city of Broken Hill, as regards population, ranks third in New South Wales, yielding place only to Sydney and

Newcastle. Its population at the 1911 census was 30,972, and in 1914 must have exceeded 35,000, since when it has fallen again to 26,337 (1921 census). It possesses substantial public buildings, a post office, town hall, theatres, a technical college, libraries, and a well-equipped hospital. Steam trams run to the suburbs, and there are good gas, electric light, and water services. For the water-supply two large dams have been constructed, one (completed in 1892, of 3940 million gallons capacity) at Stephen's Creek, ten miles away, the other (completed in 1915, of 2903 million gallons capacity) at Umberumberka Creek, 19 miles away.

The value of its mineral output to the end of 1924 was approximately 121 millions sterling, and the dividends paid by the mining companies were approximately 28 millions. The quantity of ore extracted totalled 34 million tons, the maximum output for one year (1913) being 1,744,177 tons. The ore developed and available for extraction was estimated by the government geologist in May 1925 at over 13 million tons, with unknown possibilities beyond.

Ore Treatment.—Methods of treating the Broken Hill ores have varied with the class of ore. When the mines were first opened up, the ores to be dealt with were (*a*) very rich silver ores (native silver and chlorides, iodides, etc., principally in kaolin) and (*b*) oxidized lead ores (carbonates, etc.) which were either rich enough for shipment or were smelted at the Hill to produce argentiferous lead. The lead ores, which carried high silver values and practically no zinc, were smelted direct in blast-furnaces at the Hill or elsewhere; the silver ores, containing high silver values but very little lead or zinc, were roasted, chloridized and leached. These methods, however, have not been practised for many years. The silver-lead bullion obtained from the smelters was sent to Port Pirie in South Australia for refining and separation of the metals. Later on, as it was found more economical to smelt on the seaboard, where fuel and fluxes were easily available, large lead blast-furnaces were erected at Port Pirie. As the mine-workings went deeper, and farther away from the original blocks of the Proprietary Company, the ores changed to sulphides of lead and zinc (galena and blende), carrying lower silver values. The main ore body now consists of fine-grained lead-silver-zinc sulphides, and the treatment of it is practically uniform throughout the field. At first the concentration of the ores was confined to the saving of the lead, (and with it a large proportion of the silver), the zinc largely remaining in the residues. Big dumps, aggregating millions of tons of these residues, accumulated on the surface, and quantities were used as filling for the underground workings. The difficulty was that the blende (sulphide of zinc) did not differ sufficiently in specific gravity from the worthless minerals (gangue) to allow of its separation by the ordinary methods of wet concentration. In time, however, an entirely new process was evolved to meet the case the 'Flotation' process, which has been developed by Elmore, Delprat, Potter, DeBavay and others—and by its means the big dumps of zinc residues, as well as the current production of residues from the lead concentrating mills, became a valuable asset. Zinc concentrates were made on a large scale and shipped for further treatment mainly to Belgian and German smelters, where metallic zinc (spelter) was obtained from them; a comparatively small proportion of these concentrates was treated at the Proprietary Company's own zinc distillation furnaces at Port Pirie. The war put an end to oversea shipment to foreign countries, and smelting and refining is now done at Port Pirie, at Hobart (see HYDRO-ELECTRIC DEVELOPMENTS), and in England.

At present the method of concentration is practically identical throughout the field, with minor variations by individual mines. The mixed lead-zinc sulphide ore is first crushed to pass ½-inch holes and jigged to recover the galena concentrates. The residue from the jigging is ground to pass screens having 30 holes to the lineal inch, giving a product suitable for treatment on concentrating tables (Wilfley, etc.) to get galena concentrates. The residue from the Wilfley tables, together with the slimy product produced in crushing and grinding, are treated either together or individually by a flotation process to yield galena concentrates, blende concentrates, and comparatively barren residues.

The galena concentrate assays approximately —lead, 60 per cent; silver, 30 oz. per ton; zinc, 10 per cent. The blende concentrate assays—lead 7 per cent; silver 10 oz. per ton; zinc 47 per cent. The combined recoveries of the metals range from 85 to 90 per cent. The galena concentrate at present is wholly smelted at the works of the Broken Hill Associated Smelters, Port Pirie; the blende concentrate is partly treated by the Electrolytic Zinc Company at Hobart, and partly sold overseas. The barren residues from the concentrating mills are used for underground filling or stacked on the surface. Standard types of ore-breakers, crushing rolls, jigs, concentrating tables and general concentrating accessories are used throughout the field. For the flotation process, the Mineral Separation Company's patents and machines are used for the general work, and the Bradford flotation process for special selective work. The sulphuric acid required in the flotation plants is made partly in brimstone-burning contact and chamber acid plants, and partly in chamber acid plants operating on SO_2 gas, obtained by roasting blende concentrates in furnaces of the de Spirlet type. Modern power plants, containing 3500 kilowatt A. C. generators, supply power to the bigger mines, and the water-supply for concentrating purposes is drawn partly from underground drainage in the mines, partly from the government reservoirs at Stephen's Creek and Umberumberka.

For other enterprises carried on by the Broken Hill Proprietary Company see IRON AND STEEL.

J.F.S.

Brolga. See NATIVE COMPANION.

Bromby, CHARLES HENRY (1814-1907), was born at Hull on 11 July 1814, and educated at Uppingham school and St. John's College, Cambridge (B.A., 1837; M.A., 1840; D.D. (hon.), 1864). He was ordained deacon in 1838 and priest next year, but after a short period of parochial work settled down as a schoolmaster. From 1841-3 he was head of the Stepney grammar school, and then until 1864 principal of the Cheltenham training college for school instructors. In that year he was appointed by letters patent under the Crown (the last time that process was used for colonial bishoprics) bishop of Tasmania, and enthroned in St. David's Church, Hobart, on 7 January 1865. After the disestablishment of the Anglican Church in Tasmania he organized its finances skilfully, procured local legislation that ensured the creation of a diocesan fund, had St. David's consecrated in 1874 as the diocesan cathedral, and took an

active share in the formation of a general Anglican synod for Australia and Tasmania. He resigned his bishopric in 1882, proceeded to England, and spent the next 15 years in assisting the bishops of Lichfield (1882-91) and Bath and Wells (1891-7). He died at Clifton in 1907.

His second son, CHARLES HAMILTON BROMBY (1843-1904), was Tasmanian attorney-general from 1876 to 1878.

Brooke, GUSTAVUS VAUCHAN (1818-1866) born in Dublin on 25 April 1818 and educated by a brother of Maria Edgeworth, was intended for the bar; but a visit of W. C. Macready to Dublin fired him (at 14) with an ambition for the stage, and he presented himself to the manager of the Dublin theatre, who took his address and forgot all about him. Some months later Edmund Kean failed to keep a Dublin engagement, and the manager engaged Brooke to fill the gap. His first appearance was made on an Easter Monday (9 April 1833), and permanent employment followed. He made his first appearance in London as Virginius at the Victoria theatre, but attracted little attention; his real debut was as Othello at the Olympic on 3 January 1848, when he scored a success, and followed it up with a series of Shakespearean performances. In 1851 he visited the United States, and in 1854 met George Coppin (q.v.), and entered into an engagement for 200 nights in Australia; he sailed for Melbourne in September 1854, appeared first at the Queen's theatre, Melbourne, as Othello, and during his visit played in every established theatre and in many that were run up specially for him on the goldfields. The engagement with Coppin merged into a partnership which owned the Melbourne Olympic, Theatre Royal, and Cremorne Gardens; when the partnership was dissolved, the Theatre Royal fell to Brooke, but he was no manager, and his venture proved disastrous. He returned to England in 1861, but was not very successful, the taste of theatre-goers having changed. Consequently, in 1865 Coppin again made arrangements for an Australian visit, and Brooke left England in the *London* on 30 December. On 11 January 1866 the vessel foundered, and Brooke, who had worked incessantly at the pumps, refused a seat in the engineers' boat, only sending a message of farewell to the people of Melbourne. He was sincerely mourned in Melbourne, and pressmen obtained a bust of him by Summers, which is now in the art gallery.

Brooklime. See SCROPHULARIACEAE.

Broome, SIR FREDERICK NAPIER (1842-1896), born in Canada on 18 November 1842, was the eldest son of Frederick Broome, missionary (afterwards rector of a Shropshire parish). He was educated at the grammar school in Whitchurch, Salop, migrated to Canterbury, New Zealand, in 1857 to become a pastoralist, but in 1869 returned to England and took up journalism, mainly for *The Times*. Going to Natal with Sir Garnet Wolseley in 1875 he became successively colonial secretary of that colony, colonial secretary of the Mauritius, and lieutenant-governor of the same. In 1882 he was appointed governor of Western Australia, then still a crown colony, so that he was able to exercise a good deal of influence on its welfare. His governorship was marked (*a*) by a rapid extension of railways and other means of communication, (*b*) by an agitation for the grant of responsible government, which he thoroughly approved of and did his best to forward—going to England in 1889 with a deputation, and materially helping to secure it. When in 1890 the colony obtained a constitution, his term of office there ended, and he was transferred as acting governor to Barbados, becoming next year governor of Trinidad. He died in London in 1896.

He published in 1868 and 1869 two volumes of poems, and did much writing for the *Cornhill* and *Macmillan's Magazine*. (C.M.G., 1877; K.C.M.G., 1884.)

His wife, Mary Ann Lady Broome, whom he married in 1864, was daughter of W. G. Stewart, colonial secretary of Jamaica. In 1852 she married Sir G. R. Barker, K.C.B., who died in 1860 at Simla in India. Broome being at the time of the 1864 marriage still un-titled, she retained the name 'Lady Barker' for many years, and under it published in 1870 *Station Life in New Zealand*, based on her experiences in 1864-9. *A Year's Housekeeping in Natal* (1877) followed on Broome's term of office in that colony, and *Letters to Guy* (1885) on his work in Western Australia. She died in London on 6 March 1911.

Broughton, WILLIAM GRANT (1788-1853), born in Westminster on 22 May 1788 and educated at Barnet grammar school and the King's School, Canterbury, was from 1807 to 1812 a clerk in the East India House. His personal aim, however, was to enter the Church of England ministry, and in 1814 he abandoned commerce, entered Pembroke Hall, Cambridge (B.A. and 6th wrangler, 1818; M.A., 1823; B.D. and D.D., 1836), was ordained deacon in 1818 and priest later in the same year, and until 1827 was curate of Hartley Wespall in Hampshire. This village was adjacent to the Duke of Wellington's estate of Strathfieldsaye, and in October 1828 Broughton (after a short term at Farnham) was made by the Duke chaplain at the Tower of London. Scarcely, however, had he accepted this appointment than the Duke urged him to take up the office of archdeacon in New South Wales in succession to T. H. Scott (q.v.). To this post he was formally appointed on 6 February 1829, and, reaching Sydney on 13 September, was on the 17th made a member of the legislative and executive councils. Darling, whose respect for church dignitaries almost invariably mastered his naturally quarrelsome temper, promptly recognized his zeal and value as an adviser, and not long before he resigned the governorship described Broughton as 'remarkably clear in his views, cool and dispassionate, and possessing a sound judgment.' In 1834 Broughton visited England to lay before ecclesiastical and missionary bodies the needs of Australia as regarded both suitable clergy and funds for churches and schools. Bourke had already (in September 1833) proposed to the colonial office that the archdeaconry should be made at least a bishopric suffragan to Canterbury or London—at the time it was attached to Calcutta. Consequently, one result of Broughton's campaign in England was the establishment of an independent bishopric of Australia, and his appointment to the new see with the unqualified approval of all concerned. He was consecrated on 14 February 1836, arrived in Sydney on 2 June, and on the 5th was installed during a service that lasted 5½ hours.

Broughton's term as bishop, no less than his earlier term as archdeacon, was filled with arduous supervision of his huge diocese, involving many thousand miles of travel yearly. As archdeacon he had charge of eastern Australia (to 129° E. long.), Tasmania and Norfolk Island: as bishop the whole continent and the two islands were within his jurisdiction. He was proud of his Church, and very jealous of her status in the

new colony, and on several occasions (e.g. when in Bourke's instructions the archdeacon's precedence was slightly lowered) resented what he thought were attempts to diminish her prestige. This attitude very nearly lost him the bishopric: for Bourke had coupled with his proposals for a bishopric further proposals for state support to Roman Catholics and Presbyterians, and Broughton explicitly refused to concur in a system that might 'attach men more to the errors of their Church and check the progress of the Reformation.' The colonial office, however, assured him that its offer was unconditional, and left him free to oppose or support any policy he chose. At the same time he was placed in a somewhat invidious position, since as bishop he was a member of the executive and legislative councils, and thus had an influence on legislation and governmental policy which was denied to the heads of other denominations. This was especially marked in the sphere of education. When the clergy and school lands corporation was dissolved in 1833, Bourke proposed not only state subsidies for the three principal denominations but the abolition of state aid for denominational schools and the provision of public schools for all children. Broughton told him that, though a state might tolerate several religions, it should aid only that which it believed to be the true religion; he also actively opposed the establishment of public schools, and forced Bourke to protest to the colonial office against his membership of the two councils. As Bourke foresaw, this attitude of its head roused ill-feeling against the Church of England among the other denominations, and to that extent Broughton's episcopate harmed his Church, but within it his work was unceasing and of great value. In 1847 his huge diocese was subdivided by the creation of sees at Newcastle, Melbourne, and Adelaide—Tasmania had already become a separate diocese in 1842; thenceforth Broughton's title was bishop of Sydney and metropolitan of Australasia. In 1852 Broughton again visited England to lay before English Churchmen the state of the Church in Australia, particularly in connection with the gold rush. Age, overwork, and an illness contracted on the voyage, shattered his constitution, and he died in London on 20 February 1853.

Brown. GEORGE (1835-1917), was born at Barnard Castle in Durham on 7 December 1835 and while a boy trained in a local surgery, was afterwards apprenticed to a draper, whom he soon deserted for love of the sea. After some short voyages he sailed to Quebec, and there left his ship to work in a general store at New London. Five years later he was back in England, but could not settle to any business, and his father agreed to send him to his uncle (Thomas Buddle, Wesleyan missionary) in New Zealand, on the understanding that he went as a passenger and not before the mast. In March 1855, therefore, Brown sailed in the *Duke of Portland*, with Bishop Selwyn and J. C. Patteson (afterwards Bishop of Melanesia) as fellow passengers, and lived with his uncle at Onehunga till 1860, when he was accepted for mission work, designated for Samoa, and ordained in the Centenary Chapel at Sydney. He reached Samoa on 30 October 1860, remained there for 14 years, and then moved to New Britain, where he founded a mission and superintended it for seven years. In New Britain Brown found himself suddenly in circumstances of unparalleled difficulty; four of his teachers were murdered and eaten, and the life of every white person on the islands was threatened. The white residents urged on him an active defence; he agreed, and the actual perpetrators of the murders were punished with their accomplices. Brown's share in this act of defence was severely criticized, chiefly by those at a distance who were not in possession of the facts; but Captain Purvis, who was instructed to make a full enquiry into Brown's action, reported: 'I therefore think Mr. Brown, having regard for the safety of those people entrusted to his care, could hardly have acted otherwise.' In 1881 he returned to Sydney, and in 1887 was appointed general secretary to the board of missions, a post he filled for the next 21 years. The same year he was a member of the deputation sent to Tonga by the Wesleyan conference in connection with the Shirley Baker dispute, and in the following year he again visited the group as a commissioner to report upon the best means of securing reunion with the Tongan Free Church; a third visit was paid in 1889. In May 1891 Brown founded a Wesleyan mission in New Guinea, and in May 1902 led a pioneer mission party to the Solomon Islands, after visiting both New Guinea and the Solomons in order to make preliminary enquiries. In 1891 he was elected president of the New South Wales conference, and in 1913 president of the Australasian conference. In 1908 he was placed on the supernumerary list, and died on 7 April 1917 at the age of 82, having been a minister for 58 years.

Outside his ministerial work he was an ardent anthropologist, and contributed many scientific papers to the proceedings of learned societies. In 1908 he published an autobiography, *George Brown, Pioneer Missionary and Explorer*, and in 1910 *Melanesians and Polynesians*, which he had written in 1887 for the journal of the Anthropological Institute. His collection of island curios and natural history specimens is in the Bowes museum at Barnard Castle. Personally he was one of a notable band of missionaries (including Fison and Chalmers) who without neglecting their mission work achieved results of great scientific and political value in the South Pacific. Robert Louis Stevenson volunteered unavailingly to write the story of his life, and described him in glowing terms as a man 'with no humbug, plenty of courage and the love of adventure.'

J.C.

Brown. ROBERT (1773-1858), born at Montrose in Scotland on 21 December 1773 and educated at Marischal College, Aberdeen, studied medicine at the university of Edinburgh and in 1795 joined the army as a surgeon; but his love of botanical research had mastered him while still a student, and his military career was short. On 12 December 1800 Sir Joseph Banks, with whom he had corresponded on botanical subjects, offered him the position of naturalist aboard the *Investigator*, in which Flinders (q.v.) was to explore the coasts of Australia. Brown accepted the offer—which included a condition that all memoranda, sketches or collections he might make during the voyage were the property of the admiralty, a share of the profits (if any) obtained from publication of them being reserved for Brown. Accordingly, when in June 1803 the *Investigator* was condemned and Flinders left for England in the *Porpoise*, he took a large part of Brown's collections with him, and it was lost (except a few boxes of seeds) when the *Porpoise* was wrecked. Brown himself and his

draughtsman Ferdinand Bauer remained in Australia until 1805, visiting the islands in Bass Strait, the Tasmanian settlements at Port Dalrymple and Hobart, and the valleys of the Hawkesbury, Hunter and Williams. He reached England again on 12 October 1805 in the *Investigator*, which had been patched up to make the voyage. From 1806 to 1810 he was engaged in working up the material he had accumulated in Australia, and in 1810 published his *Prodromus Florae Novae Hollandiae*, which Hooker described as 'the greatest botanical work that has ever appeared.' Brown then succeeded Dryander as librarian to Sir Joseph Banks, and on Banks's death inherited his herbarium and library, with remainder to the British Museum; within a few years he decided to transfer the collections to the museum at once, and in 1827 became keeper of the museum's botanical department. In 1835 his official title was altered to 'Keeper of the Banksian Botanical Collections and Under-librarian of the Museum.' He died on 10 June 1858.

Of Brown's value both to Australian botany and to the science of botany in general it would be hard to say too much. Hooker, whose eulogy of the *Prodromus* has already been quoted, said that Brown himself 'united a thorough knowledge of the botany of his day with excellent powers of observation, consummate sagacity, an unerring memory, and indefatigable zeal and industry as a collector and investigator.' Humboldt called him '*botanicorum facile princeps*,' and Asa Gray said 'No naturalist ever taught so much in writing so little, or made so few statements that had to be recalled, or even recast.' These praises, however, came to him late in life or posthumously. The *Prodromus* itself remains a fragment, lacking beginning and end, because the sales were so small—Brown withdrew it from sale in 1816, when only 26 copies had been disposed of. He revised it for a German edition published at Nuremberg in 1827, and in 1830 published a small *Supplement* describing some new Proteaceae; but the *Prodromus* as originally conceived was never completed. He also wrote botanical appendices for Flinders's *Voyage to Terra Australis* (1814) and Sturt's *Narrative of an Expedition into Central Australia* (1849). His minor miscellaneous works were collected and edited for the Ray Society by J. J. Bennett in 1866-7. The Linnean Society, of which he became an associate in 1798, made him a fellow in 1822 and its president in 1849-53; the Royal Society made him a fellow in 1811; Oxford gave him an honorary D.C.L., Cambridge an LL.D., and Prussia a knighthood of the order Pour la Mérite. An appreciative account of his work is given in Maiden's *Sir Joseph Banks*, pp. 100-123.

Browne. THOMAS ALEXANDER (1826-1915), son of Sylvester John Browne of the East India Company's service, was born in London on 6 August 1826, brought to Australia by his parents in 1830, and educated at the Sydney College under W. T. Cape (q.v.). At the age of 17 he entered on station life in western Victoria, and from 1844 to 1856 was the owner of Squattlesea Mere in the Port Fairy district; he then purchased stations on the Murray (1858) and Murrumbidgee (1864), but lost heavily in the droughts of 1866 and 1869, and abandoned squatting in 1870 to become a few years later police-magistrate and goldfields-warden at Gulgong in New South Wales In 1887 he was transferred to Albury, and retired from the public service in 1895. From 1870 onwards, using the *nom de plume* 'Rolf Boldrewood,' he wrote stories of squatting life, one of which (*Ups and Downs*) was published in London in 1878; and *Old Melbourne Memories*, a collection of sketches of early pastoral days in the 'Western District'—possibly the most valuable work he did—was published in Melbourne in 1884. But his first success as a novelist—and the one by which he is still most widely known—was *Robbery Under Arms*, published in 1888, a piece of effective melodrama constructed round the many (mainly true) stories of Australian bushrangers; this he followed up in 1890 with *The Miner's Right*, a tale of the goldfields in which his experiences at Gulgong were fully drawn on. Other novels (many of which had been written long before and published serially) followed at the rate of one a year until 1906, but the pattern was too similar in all to let any stand out as the first two had done. He died in Melbourne on 11 March 1915.

Rolf Boldrewood's work, while it cannot be classed high as literature, has been in many ways extremely valuable to Australia. Contrasted with the pessimism of Gordon, the melancholy of Kendall, the morbidity of Marcus Clarke—the three writers by whose work Australia was until quite recently known to the outside world—his eager and virile romanticism, the reflection of a manly and generous nature, helped to stimulate a belief in the country among both Australians and readers overseas. His plots are often confused and sometimes jejune; his character-drawing, in regard to his principal characters, is unconvincing; the aspirations of his hero and heroine to end their lives in England class him with Gordon and Kingsley rather than with genuinely Australian authors. But in his gallery of well-studied minor characters he has embodied much of the real bush life of Australia; and the fine adventurous gallantry which he exalted, and so obviously loved, is a virtue proper to manly youth all the world over.

Browne. SIR THOMAS GORE (1807-1887), son of Robert Browne and brother of a well-known bishop of Ely and Winchester, was born on 3 July 1807, and entered the army in 1824 as ensign (lieutenant, 1826; captain, 1829; major, 1834; brevet lieutenant-colonel, 1842). In the first Afghan war (1842) he commanded a regiment and saw much fighting. During the early thirties he had been colonial secretary in the Ionian Islands, and in 1851 reverted to this type of work, becoming governor of St. Helena (with the rank of colonel) in that year and governor of New Zealand in 1854. His term of office there was troubled by a native war, partly due to his unsympathetic treatment of Maori claims in regard to land customs. The 'King' movement, intended to band the Maoris together and give the tribes a single head who could negotiate on equal terms with the English governor, originated in his time. In 1861 he was replaced by Sir George Grey (q.v.), and transferred to Tasmania; leaving in 1869, he administered Bermuda for nine months in 1870-1, and then retired. He died on 17 April 1887. (C.B., 1843; K.C.M.G., 1869.)

Bruce. GEORGE (1778-1819), born at Shadwell in London and while still a child employed in a rope factory, soon escaped parental control, was consigned to the Shadwell workhouse, and from that institution apprenticed to a North Sea fishing-smack. He deserted, became pot-boy at an inn, entered on a career of petty thieving,

and in 1791 was sentenced to death for breaking a window and stealing two handkerchiefs. This sentence being commuted to one of transportation on account of his youth, he was sent to Port Jackson in the transport *Royal Admiral* and reached Sydney on 7 October 1792. He was even then only 14 years old, and the authorities employed him to help George Caley (q.v.) in collecting insects, then as personal servant to a convict superintendent, then as servant to Grose, at that time lieutenant-governor in charge of the colony. Grose gave him a free pardon, and he went back to sea in the *Cumberland* (a 29-ton schooner), was one of the crew during her survey work in Bass Strait in 1802, and left her when Flinders took her over in September 1803. He then joined the local police, but for misbehaviour was dismissed and imprisoned, for joining in a fight was sentenced to 200 lashes, and to avoid this punishment absconded into the bush; five months of danger and misery drove him back to the settlement, and in the end King (who needed experienced sailors) pardoned him and sent him to join the *Francis*, and when she was wrecked to the *Lady Nelson*. In February 1806 this vessel was employed to take a Maori chief, Te Pehi (usually known as Tippahee), back from Sydney to his territory on the Bay of Islands. Te Pehi being taken ill during the voyage, Bruce was set to nurse him, and made himself so useful that the chief gained permission to keep him. He thus became the first Englishman to reside among the Maoris. After seven months he was tattooed, made a chief, and given Te Pehi's youngest daughter for a wife.

During his two years' stay at the Bay Bruce aided several British vessels to obtain cargoes; but in 1808 the master of a passing vessel, the *General Wellesley*, enticed him and his wife aboard, took them to Fiji and thence to Malacca, and when compelled to let Bruce land there went off by night with the Maori girl to Penang, and there disposed of her to a Captain Ross. Following her up in H.M.S. *Scourge*, whose captain stood his friend, Bruce recovered his wife after three months, was taken on to Calcutta, and from that port by the intervention of the governor-general (Lord Minto) obtained passage back to New Zealand in the *Union*. This vessel, however, had to put in at Hobart during June 1809, and Bligh (who was lying in Storm Bay aboard H.M.S. *Porpoise*, and could get no provisions from the shore) commandeered her stores; before she could replace them Macquarie ordered all vessels to Port Jackson, and the *Union* hurriedly landed her passengers there on 17 January 1810 and by the 8th of March was on her way back to Calcutta. Bruce at once appealed to Macquarie for a passage to the Bay of Islands, and arranged with a syndicate (which included Simeon Lord) to be their agent there; before he could sail, his wife died, and news came from New Zealand that Te Pehi had treacherously murdered the crew of a British trading vessel, the *Boyd* (see NEW ZEALAND). The massacre was a fact, but Te Pehi had taken no part in it except to rescue four members of the *Boyd's* company; still, it put an end to any immediate prospect of return to New Zealand, and Bruce (who after his wife's death was not so anxious to return) shipped aboard the *Porpoise*, went back to England, and enlisted in the navy. In 1813 he memorialized Earl Bathurst in the hope of procuring a passage back to New Zealand. But his confused and unreliable story drove Macquarie (to whom it was referred) into angry contradiction and an account of Bruce's life that was just as unreliable; his petition was refused, he grew prematurely old and decrepit, was admitted into Greenwich hospital on 18 April 1817, and died there on 9 February 1819. His manuscript diary, dictated while at the hospital to fellow-pensioners and left there after his death, is in the Mitchell Library at Sydney.

W.J.

Brush Turkey. See MOUND-BIRDS.

Bryant, WILLIAM, a West-of-England fisherman who was transported in the First Fleet for 'having interrupted revenue officers in the execution of their duty'—i.e. for assisting smugglers—was employed by Phillip to superintend the fleet of fishing-boats which in the early years of the colony provided settlers with a large proportion of their food. According to Collins, 'every encouragement was held out to this man to keep him above temptation . . . . but he was detected in secreting and selling large quantities of fish;' in 1789 he was punished severely, but was too valuable an expert to be deprived of his job, and for two years longer continued to run the fishing fleet. On 28 March 1791, however, at the moment when according to his own statement his sentence was on the point of expiry, he with his wife and two infant children and seven other convicts put to sea in a fishing-boat. The names and sentences of these convicts are worth recording. Bryant's wife had been sentenced to death for stealing a cloak, but given seven years at Botany Bay in lieu of hanging; she had still two years to serve when she escaped. Cox, Allen, and Lilley had life sentences, Allen for stealing handkerchiefs, Lilley for stealing a fish-net, a watch and two spoons. Bird and Martin had still a year to serve out of a seven-year sentence; the latter had been convicted of stealing 20 lb. of old lead and iron. Of Morton, who died on the way home, we know only that he was a seven-year convict with five years still to go, and that he knew something of navigation. The seventh man is rather a mystery; Collins calls him 'Samuel Broom;' at a later trial he was 'John Butcher,' a man 50 years old who had been given seven years for stealing three pigs. (For that matter Samuel Bird was known in Timor as John Simms, though he was Bird again before he died.) Of the nine adults, therefore, one was almost or actually free and three others had but a short time to serve; but, as they explained later, starvation was what they feared and ran away from. These details, though scarcely relevant to the story of Bryant's escape, serve to illuminate the conditions under which at the end of the eighteenth century transportation was carried on.

The escapees' boat was in good condition and provisioned with flour, rice, pork, and a ten-gallon keg of water; Bryant had also bought from the master of a Dutch vessel then in port a chart, quadrant, and compass, and had obtained from him a good deal of useful information about course and currents. The boat was steered northwards along the coast, with a view of reaching Timor. For five weeks it rained continually, and fear of hostile blacks prevented the party from landing often. From their description of one resting-place it has been identified as Port Macquarie. Until they reached the Gulf of Carpentaria the natives they saw differed little from those with whom they were familiar near Sydney, but in the Gulf they were chased by large sailing proas (probably Malay) and barely escaped capture by pulling hastily to windward. Reaching Kupang in Timor on 5 June,

they pretended to be refugees from an English vessel that had foundered on her passage between India and New South Wales. The Dutch treated them with great kindness, but their behaviour after a time roused suspicion, and some of them when in drink betrayed the secret. During September Captain Edwards of the *Pandora*—which had been wrecked in Torres Straits on 29 August (see BOUNTY, MUTINY OF THE)—reached Timor in an open boat, and on 5 October the escapees were handed over to him. He took them to Batavia, where Bryant and one child died in hospital; then in a Dutch vessel to the Cape of Good Hope, Cox (who fell overboard), Bird (Simms), and Morton dying on the way; at the Cape he handed them over to Captain Parker of the *Gorgon*, and in her they reached England with the loss of Bryant's second child. The survivors were tried over again at the Bow-street police court in July 1792, and declared they would rather be hanged than sent back to the colony; but in the end Mary Bryant (after being visited in Newgate by 'a gentleman of high rank in the army') was pardoned, and Allen and Lilley, being 'lifers,' were sent back to undergo their sentence. Butcher had an easier fate. On 23 January 1793 he wrote from Newgate to Henry Dundas—then in charge of the home office—a remarkable letter (given in full in the *Historical Records of New South Wales*) in which he claimed a 'thorough knowledge of all kinds of land' and an ability for 'bringing indifferent lands to perfection,' and proposed to reorganize agriculture in New South Wales and 'render it a great deal more productive.' As a result of this offer he was released from Newgate, enlisted in the New South Wales Corps, sent back to the colony and on 5 September 1795 (in the last few days of Paterson's lieutenant-governorship) granted 25 acres of land 'in the district of Petersham Hill.' But of his efforts to reorganize Australian agriculture there is no trace left.

W.J.

Buckley, WILLIAM (1780-1856), born at Marton near Macclesfield in Cheshire in 1780, after a short apprenticeship to bricklaying joined the Cheshire militia, and in 1799 passed thence as a volunteer (being 6ft. 6in. high and of a fine figure) into the 4th regiment of the regular army and served in the Netherlands under the Duke of York. Two years later, on 2 August 1802, he was convicted at the Sussex assizes of receiving stolen property and sentenced to transportation for life. The story sometimes told of him, which represents him as having been involved in a conspiracy to shoot the Duke of Kent at Gibraltar, was probably invented by his first biographer, John Morgan, and is incompatible with official documents that give the facts stated above. Buckley was transported to Australia in the *Calcutta*, which carried the expedition under David Collins (q.v.) intended to occupy Port Phillip. When Collins in November 1803 landed his party near Sorrento, he chose Buckley for one of his body-servants; and the stalwart young adventurer, promptly taking advantage of the greater freedom thus ensured to him, almost at once slipped away from the camp with three others and took refuge with the natives. His example was followed, and before Collins abandoned the settlement 21 convicts had attempted flight, though two-thirds of them either were captured or returned voluntarily. Among those who did not return, and were accordingly believed to have perished miserably, were Buckley and two of his companions.

Nearly 32 years later, on 12 July 1835, the party which John Batman (q.v.) had left in occupation at Indented Head was visited by a band of natives one among whom was of great stature and distinctly European in features, with a tattoo mark 'W.B.' on one arm. After much questioning he was persuaded to say 'bread' when a piece was offered him, and in a few days he remembered other English words and was gradually enabled to give some account of himself. In later years a story, purporting to come from his own lips, of his adventures during the missing 32 years was published in Tasmania, but its authenticity is doubtful. It is probable, however, that on leaving Collins's camp he made north along the bay shores as quickly as possible in order to escape pursuit, but dared not go too far from salt water (hoping, it may be, to be picked up later on by a sealer or stray merchant-vessel) and so worked down the western shores into the Geelong district and (according to his own account) even into the Otway ranges. For over 30 years, it is certain, he had lived with the Geelong blacks, ranging northwards as far as the Yarra but usually camping near the You Yangs. What happened to his companions was never ascertained.

On 28 August he received a formal pardon, and was for a time employed by the Port Phillip Association as a go-between with the natives. When Lonsdale reached Port Phillip as superintendent at the end of September 1836, he—being a captain in the 4th regiment—was naturally interested in an old soldier of his own regiment, and on 11 October at Bourke's suggestion made him constable and interpreter to the aborigines. Lonsdale for a time placed great reliance on him, but Buckley soon proved to him, as he had already done to the association, that he was unintelligent, untrustworthy, and quite incapable of rendering any useful service in connection with the natives. Bourke recommended him for a pension, but the colonial office would not consider it. On 28 December 1837 he left his employment and went to Tasmania, where the government gave him small billets—assistant storekeeper at the immigrants' home, gatekeeper at the female penitentiary—and in 1852 retired him on a pension of £12 a year, which the Victorian government when appealed to made up to £1 a week. It was at this time (before the Victorians had come to his aid) that he collaborated to some extent in the *Life and Adventures*. Early in 1856 he was thrown out of a cart, and died of his injuries on 2 February.

The Life and Adventures of William Buckley, by John Morgan, was published at Hobart in 1852. James Bonwick in 1856 published a monograph on Buckley, and many authors have used his career as a peg for an account of the Port Phillip aborigines.

Budgerigar. See PARROTS.

Buffalo, the vernacular name of *Bubalus buffelus*, a species of cattle native to India, which has spread in a semi-domesticated form to Italy on the one side and the Malay Archipelago on the other. In 1825 Maurice Barlow, then commandant at Melville Island, imported three buffaloes to that station from Timor; as they throve, and the cattle sent up from Sydney did not, another consignment of 15 was imported in December 1827, and 16 more in August 1828, out of which eight were sent to Raffles Bay. In February 1829, however, Collett Barker reported against further importations: the buffaloes, he said, were too poor to kill on arrival and too wild

to retain in captivity when once ashore. When, however, the Port Essington settlement was garrisoned in 1838, buffaloes were again imported from Timor, so that, when in 1849 that settlement also was abandoned and northern Australia left for a time to itself, there were several buffalo herds in existence. Those on the mainland, following their instinctive desire for water, left the Coburg Peninsula for the swamps of the lower Alligator valley and rapidly increased in numbers. In 1857 the beginnings of a new herd were made by accident. The barque *Florence Street*, chartered to bring buffaloes to Sydney to supply an exceptional demand for meat on the diggings, loaded up at various ports of the Malay Peninsula and Burma, and on her return voyage was caught in a typhoon and driven ashore in Cambridge Gulf; most of the beasts she carried were drowned, but some escaped to shore and established themselves in the water-meadows of the lower Ord. In 1885 Thomas Cahill discovered great herds in the Alligator valley, and proceeded, with two or three partners, to kill them off for their hides at the rate of 1500 to 2000 a month; although it was estimated that the herds numbered at least 60,000, this rapidity of destruction soon reduced them to scarcity. Another hunter rented Melville Island, with about 6000 buffalo, and exported hides at the rate of 2000 a year. In 1912 it was still possible to report officially that buffalo were numerous, but by 1923 it could be said only that they 'formerly existed in large herds.'

Bugs. See HEMIPTERA.

Building and Ornamental Stones.

The existence of good building stone in Australia was discovered by the first settlers, and from an early date the sandstone of Sydney, which is considered one of the best building materials on the continent, has been freely used; later, one or two local granites, in which Australia is particularly rich, were introduced; more recently still local marbles, the supply of which is practically inexhaustible, have been much favoured by architects. To-day local stone is a prominent feature in all the cities of the Commonwealth, especially in Sydney. The first specimens exhibited abroad were sent to the exhibition of 1851; the finest collection was shown at the Franco-British exhibition held in London in 1908, and was awarded the Grand Prix, the jurors stating that 'the exhibits of marbles were especially noteworthy, and served to convey to British and Continental architects an adequate notion of the richness of New South Wales in these splendid materials, some of which were admitted by competent judges to surpass any European marbles found in commercial quantities.'

Granites are fairly well distributed throughout coastal Australia, in bosses and huge outcrops as well as in veins or dykes; they are not known to exist on the plains of the interior. In colour they range from dark red to pale pink, and from various shades of grey to evergreen. In texture they may be described as 'very coarse,' 'medium,' and 'fine.' In a crushing-strain on a 3-inch cube with a 100-ton testing-machine the results varied from 55 tons to 70 tons. Very few flaws occur, so that during preparation for use the granites require no 'filling in' or other methods of cobbling to produce an even and regular surface. They have not been exposed long enough for their durability to be tested. *Red granites* have scarcely been exploited commercially. The best in use at present, which comes from Gabo Island, is a particularly good fine-grained decorative granite, the constituents being mixed in about equal proportions, and so producing a fairly uniform texture. The colour is often a deep red. This and the Tarana granite (of similar texture) are the only two on the market in New South Wales, but in South Australia 'Murray Bridge' red is also used. In New South Wales several rich red coarse-grained granites, the felspar predominating, have recently been found at Mudgee, Michelago, and Tarana; red granite also occurs in the State at Albury, Burrinjuck, Braidwood, Cowra, Bungendore, Carrick, Cooma, Grenfell, Inverell, Jerangle, Jindabyne, Cox's River, Lithgow, Maffra, Mulloon Creek, Murrumbateman, Rylstone, Tarago, Trial Bay, and Wombeyan; in Victoria at Beechworth, Inglewood, and Woolamai; in Queensland, at Stanthorpe and Townsville; in South Australia at Midgee near Charleston, and Wudinna; in Tasmania at Heemskirk. *Grey granites* occur more extensively than the red and vary similarly in texture, structure, and shade. They are all first-class building stones —the dark grey of Uralla being the finest and most easily worked—and are used extensively in the State capitals. In New South Wales they are found at Adelong, Albury, Arnprior, Bathurst, Braidwood, Breadalbane, Bredbo, Bungendore, Burrowa, Collingwood near Gunning, Cooma, Cowra, Goulburn, Gundagai (this is a particularly beautiful granite but too hard to be much worked), Gunning, Harden, Inverell, Jerangle, Lake Bathurst, Montague Island, Moruya, Oberon, Tenterfield, Trial Bay, Tumut, Uralla, Yass, and Young; in Victoria at Beechworth, Harcourt, Harrow, Tallangatta, and Trawool; in Queensland, at Greymare west of Warwick, Enoggera and Mount Crosby west of Brisbane, and Cooktown; in South Australia at Minnipa, Moody, and West Island; in Western Australia at Meckering; in Tasmania at Gladstone. Other granites occur which can hardly be classified as grey or red; the colour is variegated, green predominating, due to the abundance of green felspar intermixed with pink. Such a stone occurs at Albury, Braidwood, and Bungendore in New South Wales.

Enormous masses of *gneiss* are scattered throughout the Commonwealth, notably in South Australia and on the west coast of Tasmania; but the possibilities of this rock as a building-stone have not yet been tested on a large scale though the court-house at Goulburn, the post-office at Cooma and churches in several inland towns are built of it.

Trachyte, so-called, is a favourite stone with Sydney architects. Petrologically it is not regarded as a trachyte, but rather as a syenite (Bostonite). Commercially it is known as Bowral trachyte, and is obtained in the locality from which it derives its name. It is of unique colour—a dark olive-green, or perhaps dark grey. Occasionally it is streaked with narrow veins of sanidine (glassy orthaclase), hornblende and aegirine crystals. It takes a fine polish, and some of the finest architectural structures in Sydney are built of it. At Orange in New South Wales there are large flows of true trachyte, which is of great repute amongst local builders: it is very hard and durable, polishes to a soft grey or buff base colour and makes a good flagging-stone for pavements.

Porphyry occurs in almost any portion of the southern tableland of New South Wales, in con-

junction with Silurian and Devonian rocks. It takes a beautiful olive-green polish much resembling that of serpentine, but its hardness will always give it a constructional superiority over the softer material. Churches have been constructed of it in districts where it occurs. A large outcrop of felspar porphyry is found in the Gawler Ranges of South Australia.

Diorite, in spite of its frequent good colour, is not favoured by architects owing to its hardness, which adds to builders' costs. Near Goulburn in New South Wales a fine-grained, dark coloured diorite is extensively developed, and the rock, which takes a good polish, has been largely used in the construction of local buildings. Other places in New South Wales from which this stone has been recorded are Bumbaldry, Jerangle, Tarago, Tumut, and Wee Jasper; in Victoria, Stringer's Creek and Walhalla.

Basalt is fairly common throughout the eastern States (as a volcanic outcrop in many places) showing in its distribution varying textures, from very fine to coarse and vesicular; all varieties have been used more or less in architecture in Victoria, and occasionally in New South Wales and Queensland.

Dolerite. There appears to be no record of the utilization of this stone as a building material proper (so to speak); but it has been tested in the form of steps, and found durable and satisfactory, as it neither wears smooth nor takes a high polish.

Marbles are probably the most extensively distributed and valuable of all Australian building material; it is doubtful if any other country is so rich not only in amount but in variety of material. The first-known deposit was discovered by surveyor Davidson in 1842 on Burangylong (Grove) Creek, a tributary of the Abercrombie River on the western slopes of the main range in New South Wales. The creek, Davidson wrote to Sir Thomas Mitchell (q.v.), runs under a tunnel, and in the tunnel were 'masses of the most beautiful white marble.' This tunnel is better known as the biggest of the Abercrombie caves (see LIMESTONE CAVES).

As yet only the surface deposits have been worked. The more populous States have, of course, opened out most quarries. Next to New South Wales, South Australia has given most attention to her marbles, and has worked some quarries for a long period, but lack of population has militated against their greater development. The occurrence of marbles in Victoria has long since been ascertained, but known deposits occur in remote localities, and hence are costly both to produce and to transport. Queensland is rich in marbles, still unexploited. Throughout Australia the industry is only in its infancy, but specimens are exhibited at the various State museums. The marbles have very few flaws and require no 'filling in.' They are of the usual scale of hardness, but are far more compact than imported marbles, and under a compression test on a 100-ton machine endured a higher crushing strain than granite. Their durability has not yet been tested. Marble deposits are known at the following places:—

New South Wales:—Abercrombie, pale, almost white; Adelong, white and green; Attunga, brecciated, coarse, on red ground (the most decorative of the marbles—when polished it shows exceptionally big fragments, and so produces figures suitable for majestic columns in large buildings); Bibbenluke, black and white; Binalong, sage-green; Bingara, brecciated; Borenore, a breccia of various colours, red and blue predominating; Brungle Creek, white; Buckeroo, many-coloured; Bumbaldry, mostly red; Bungendore, dark grey; Bungonia, buff-coloured; Burrowa, red; Caleula, whitish ground, with red, green and yellow bands—a beautiful stone, extensively used in Sydney for internal decoration; Caloola, white; Carrol, variegated; Coolalie, white, with reddish or yellowish tinge; Cooma, white; Cow Flat, whitish; Cowra, dark; Cudal, bluish black; Fernbrook, many-coloured; George's Plains, white; Gilmore (near Tumut), fine statuary marble equal in quality to Carrara, also a yellow-and-black-banded variety; Goulburn (Shea's Creek), red; Gundagai, little known; Havilah, white; Jeir, chocolate; Jenolan, unworked; Kempsey, of warm chocolate colour, with small white crinoids; Limekilns (near Bathurst), many-coloured; Marulan (the first marble worked in Australia), variously marked; Michelago, variegated; Molong, many-coloured; Moonbi, extensive but undeveloped; Mudgee, many-coloured; Nemingha (crinoidal) rich red ground, ornamental; Orange (Douglas), black with white streaks; Parkes, variegated—and white statuary marble at Ashburnham; Portland, reddish coloured; Queanbeyan, laminated, with a great variety of colours; Rockley, black and white; Rylstone (a locality rich in marbles), (*a*) black and white, (*b*) ivory ground with yellow veins, and rich, (*c*) a yellow marble of great beauty which, like the ivory of the same district, is unique among Australian marbles, (*d*) satin grey, (*e*) rose-coloured; Springhill, black with well-marked fossils; Tarago, black with yellow veins; Taree, grey, oolitic; Tarrabandra (near Tumut), white; Tumut, variegated; Warialda, white ground, black stripes—also a red, very ornamental; Windellama, black, comparable almost with the black marble of Belgium; Yass, black—also a fossiliferous variety. In New South Wales no distinctly blue marble is yet known, but the Marulan marble has sometimes blue markings.

Victoria:—Buchan, two-coloured marble, black and grey or drab, also one with white streaks (the black Buchan marble is in the same class with the marble of Windellama); Galena Point (near Geelong), a stratified limestone, coloured or striped—'has a handsome appearance when polished,' Chapman states; Limestone Creek, (*a*) with red and pink markings on a white ground, (*b*) pale grey, (*c*) slate-coloured; Mansfield, crinoidal, with white streaks and dark markings; Martin Creek, black; Moorabool, with a yellowish tinge; Mount Tambo, bluish, fine-grained; Orbost, fawn ground with pink and white streaks; Thomson River and Toongabbie, both black, with white crinoids; Waratah Bay, black with white streaks; Waurn Ponds, dark yellowish or buff.

South Australia:—Angaston, (*a*) white with cream tints, (*b*) pink; Kapunda (the main source of supply for South Australia), (*a*) fine grey, with dark and lighter patches, (*b*) pale fawn-coloured, (*c*) grevish ground, with banks and streaks of black; Macclesfield, several varieties, the principal being (*a*) cream, (*b*) grey, (*c*) dark grey, (*d*) pink, (*e*) red.

Queensland:—Broken River, west of Townsville, fine white marbles, taking a good polish; Calliope, near Port Curtis, white (could be used for statuary), also fine-grained pink, blue and red; Chillagoe, fine white; Marmor, 26 miles south of Rockhampton, dark blue with large encrinites; Northumberland Islands, white, pink and blue; Rosedale, north of Bundaberg, blue and white; Ulam, south of Rockhampton, coarse

white. Marbles are also reported from Herberton, Mount Roundback near Bowen, and the area between Inglewood and Texas on the New South Wales border.

Western Australia has not yet been exploited for marbles.

Australia has extensive areas of *slate* country. Good building slates have long been known, and several varieties quarried; they are undoubtedly good roofing slates, comparable with those at present imported.

In *serpentine* Australia is rich. It has not received much attention except in New South Wales, where it occurs in the Gundagai, Macleay River, Port Macquarie, Tarrabandra, and Tumut districts. In Queensland it has been reported from Canoona, Kandanga south and Kilkivan west of Gympie, and Cawarral north of Rockhampton.

With *sandstone* of building quality Australia is very fairly provided. The extensive 'freestone' deposit on which Sydney is built affords an excellent building stone. Victoria has so far not yielded a good freestone. The deposits in Tasmania and Queensland have been used in public buildings, and Western Australia has a good sandstone at Donnybrook. Ravensfield sandstone, quarried near Maitland in New South Wales is of a warm sepia-brown colour, and is finer in texture than the Hawkesbury variety. The sandstones of Australia vary in grain, texture, and colour and so lend themselves to widely different schemes of architectural beauty. Their durability has been well proved—e.g. the Macquarie obelisk at Sydney shows no signs of decay after an exposure to the weather of more than 100 years.

See the *Official Year Book of the Commonwealth*, No. 9, pp. 446-466; No. 12, pp. 89-95.

R.T.B.

Bulbine, a genus of the family Liliaceae, consisting of perennial herbs (very numerous in Africa) with long awl-shaped leaves and a more or less tuberous root-stalk. The two species indigenous to Australia, *B. bulbosa* (Wild Onion) and *B. semibarbata*, have yellow flowers scattered singly along a slender flower-stem; capsule nearly globular, with a few black seeds. The wild onion, which is endemic in Australia, is reputed to be poisonous to stock.

Bull, John Wrathall (1804-1886), born at St. Paul's Cray in Kent on 23 June 1804, at an early age turned his attention to farming and became a dairy farmer in Cheshire. In 1838 he migrated to South Australia to deal in stock, buying from the overlanders to re-sell to new arrivals; but the financial crisis of 1839 drove him to abandon this business and settle near Mount Barker as a stock-owner, with agriculture as a side line. The crisis of 1842-3 (which affected all the Australian settlements) again brought him near ruin, and he was forced to concentrate on agriculture: his attention was thus called to the very primitive methods employed, requiring a great number of field hands, who at the time were unobtainable except at exorbitant wages. He devised the plan of 'thrashing a standing crop'—i.e. taking the grain from the ears as they stood and leaving the straw untouched in the field. In September 1843 he exhibited a model constructed on this principle, but it found no favour except with John Ridley (q.v.), who immediately constructed a reaping machine that was successfully used during the ensuing harvest. A good deal of heat has since been developed over the question whether Bull or Ridley should be credited with the invention of the 'stripper,' but Bull himself never complained: his own account is that he had placed his model at the service of the public, he himself and several others afterwards constructed machines embodying the stripping principle, and of them all Ridley's, which was the first, proved also the most suitable. In 1882 parliament voted him £250 in recognition of his share in the improvement.

In 1852 Bull went off to the Victorian goldfields and had moderate success, but returned in 1853. He then became manager of the Gillies estate at Glen Osmond, planted a vineyard there, and established a depot in Adelaide for the sale of his own and other colonial wines. Some years later he began to write a history of the colony, and circulated many chapters of it privately: this resulted in the publication in 1875 of *Early Experiences of Life in South Australia*, an unsystematic but often illuminating account of the first 50 years of the colony's existence from a non-political point of view. He died on 21 September 1886.

Bullhead. See Port Jackson Shark.

Bull Oak. See Casuarinaceae.

Bullrout, a common estuarine fish (*Notesthes robusta*) of the northern parts of New South Wales and Queensland, which ranges upstream to fresh water. It is armed with large movable spines on each side of the snout and others on various parts of the head, and its dorsal and anal fins are each provided with a row of stout spines; some of them have definite venom-glands at their bases, and grooves on each side to convey the poison into any wound they may inflict. The bullrout is fond of lying quietly among stones and weeds in rivers; if trodden upon by an incautious wader, it inflicts injuries that cause intense pain and inflammation. It is marbled with brown and black, and reaches a length of 12 inches. Notwithstanding the venom-glands, the flesh of the bullrout is good eating. A.R.McC.

Bulrush, the popular name of *T. angustifolia*, the only species indigenous to Australia of the genus *Typha* (family Typhaceae), which consists of reed-like marsh or aquatic herbs with a creeping tuberous subterranean stem from which the leaves and flower-stems arise. The Australian species is possibly identical with the common European form (*T. latifolia*), which is widely distributed. The flowers are unisexual; petals and sepals represented in the males by spoon-shaped scales, and in the females by a ring of hairs; the whole, when matured, packed in a soft, brown, dense, cylindrical, cushion-like spike at the top of the flower stem 3-6 inches long and one inch in diameter, the males above, usually separated from the females by a short bare interval; flowering stems erect, 6-10 feet high; the flat, narrow leaves slightly longer. The Lachlan River aboriginals call the plant 'balyan' and (according to Sir T. L. Mitchell) use the rhizomes to make a sort of flour; others masticate the fibrous part of the root-stock and make it into a coarse twine. On the Murray River the soft woolly flower spikes are collected and sold for stuffing pillows. The root-stock, which abounds in starch, is astringent and is used in eastern countries in cases of dysentery.

Bunyip, an apparently fabulous animal supposed to haunt swamps and shallow lakes in Australia and Tasmania. While there is no evidence for the existence, now or in any age, of a large

marsupial otter, such a creature is not unthinkable. But, even if it did at one time exist, and was the origin of the 'bunyip' legend, its qualities and features have been so confused with those of crocodiles in Queensland and seals on the southern coast that the resulting monster—in which many aboriginal tribes firmly believed—can only be described as fabulous. Latrobe during his administration of the Port Phillip district was assured by the neighbouring tribes that there were two kinds of bunyip, and on 23 September 1847 sent to a correspondent in Tasmania sketches of the 'southern' type copied from aboriginal drawings: these have unfortunately disappeared. About the same time a skull found in 1846 on the banks of the Murrumbidgee was submitted to W. S. Macleay as that of a bunyip; but he pronounced it that of a much deformed colt, and Professor Owen afterwards decided that it was a calf's. One of the few specimens described by alleged eyewitnesses—that said to have been seen in a lagoon north of Narrandera, early in 1872—was described as 'about half as long again as an ordinary retriever dog, the hair all over its body jet black and shining, its coat very long;' this would accord with the hypothesis of a marsupial otter. The second appearance, at Dalby in Queensland, dates from 1873: it had 'a head like a seal, and a tail consisting of two fins, a larger and a smaller one.' The Great Lake in Tasmania has several bunyips to its credit: one bumped a boat in 1863, and in 1870 Francis McPartland saw three or four together; it is noteworthy that seven observers in this locality, covering about ten years, agree in describing the animal as like a large sheepdog about the head and from three to five feet long. The aboriginal monster (also called Bunyup, Kyanprati, and Tunatpan) was a far more fearsome beast: it was as big as a bullock, with an emu's head and neck, a horse's mane and tail, and seal's flippers, which laid turtle's eggs in a platypus's nest, and ate blackfellows when it was tired of a crayfish diet. This description came from a Port Phillip tribe. For the boom which was (and in some localities still is) believed to be its call bitterns are probably responsible.

Burdekin Vine. See VITIS.

Burke, ROBERT O'HARA (1820-1861), born at St. Clerans in county Galway and educated in Belgium, entered the Austrian army in 1840 and attained the rank of captain, but in 1848 returned to Ireland and joined the constabulary. In 1853 he migrated to Tasmania, but shortly afterwards crossed to Victoria, where he was appointed inspector of police. Obtaining leave in 1854 to visit England, he applied for a commission in the army with a view to service in the Crimea; but the war was over before his arrangements were completed, and he had to return to Victoria and resume his duties as police inspector. In 1859 he was chosen by an 'Exploration Fund Committee' to lead an expedition across the continent from Melbourne to the Gulf of Carpentaria. The expedition (for details of which see EXPLORATION BY LAND) was equipped from public and private funds under the direction of the Royal Society of Victoria; but, largely owing to Burke's impatient temperament and complete ignorance of bushcraft, it failed hopelessly, and Burke and his second in command, W. J. Wills, died of exhaustion on Cooper's Creek towards the end of June 1861.

Burns, SIR JAMES (1846-1923), born at Polmont near Edinburgh on 10 February 1846 and educated at the Edinburgh high school, migrated with an elder brother to Queensland in 1862 and, after some years of pastoral experience was just about to join his brother in the management of a store near Brisbane when in 1867 gold was discovered at Gympie. Young Burns was the first man from Brisbane to reach the field, and in a few months was controlling stores at three mining centres, besides acquiring an interest in several mines. In 1870 he revisited Scotland, and on his return to Queensland in 1873 found that the Charters Towers goldfield, discovered the year before, was rapidly making Townsville an important port. He settled there, developed a business both as storekeeper and as shipping agent, and took into partnership Robert Philp (q.v.), whom he left in charge in 1877 when he decided to make Sydney his headquarters. In 1883 he founded the firm of Burns, Philp & Co., by formally amalgamating his own businesses at Sydney, Thursday Island, and Normanton with those carried on in Philp's name at Townsville, Charters Towers and Cairns. This firm both by its shipping enterprises and by its ventures in storekeeping, timbergetting and pastoral work pioneered the development of great areas in northern Queensland, and gradually extended its operations to New Guinea and the islands of the western Pacific; its fight with the German government over an attempt to exclude its trading vessels from the Marshall Islands in 1904-8 became a matter of Imperial concern, and established a precedent in international law.

But Burns was not merely a business man. In 1888 he enlisted in the New South Wales lancer regiment, in 1891 was made captain of the Parramatta troop, and in 1897 became colonel of the regiment. In 1904 he became brigadier-colonel commanding the 1st brigade of Australian Light Horse, but retired in 1907, in which year also he was nominated to the legislative council. For 19 years he was president of the New South Wales Highland Society, and for 12 a trustee of the Australian museum. During his later years his chief interest was the Burnside homes for orphans, built on his own land at Gowan Brae near Parramatta and largely endowed by him. He died at Gowan Brae on 22 August 1923. (K.C.M.G., 1917.)

Burrawang, the popular name of *Macrozamia spiralis*, the best-known and most abundant species of the genus *Macrozamia* (for which see CYCADACEAE). The name is said to have been given because the tree is common round Burrawang (near Moss Vale in New South Wales); but its original form is 'burwan,' and the form 'burrawong' is used for a Queensland species. *M. spiralis* extends coastally from Victoria to Queensland. In some districts the stem reaches a height of 6-7 feet, but it is usually 6-18 inches high. The upper part is covered with a fine brownish wool (*pulu*) used for stuffing couches, mattresses, and other upholstery. A large percentage of power-alcohol has been obtained from the trunk. The leaves cause rickets in cattle browsing upon them; the matter is still under investigation, but no poisonous substance has been detected, and the opinion is generally held that the disease arises from malnutrition caused by eating a bulk of indigestible fibrous matter. The palm-like

leaves, when dried and treated with a preparation which preserves their colour, are used for decorative purposes. Before the war the preparation of these and other ornamental leaves, including the Giant Maidenhair (*Adiantum formosum*), had become a minor industry in the coastal districts. Since the war several by-products have been discovered, including a dye said to have the qualities of cochineal, and fibre from which a paper-pulp useful for belting or packing can be manufactured; the 'bulbs' also contain 15 per cent of starch and 30 per cent of pollard, the latter having been found useful as cattle-fodder in time of drought.

Burrinjuck. See IRRIGATION.

Burrs. See NOXIOUS PLANTS.

Burt, SIR ARCHIBALD PAULL (1810-1879), was born at Richmond in England in 1810, and educated at a private school; he studied law at Oxford, and in 1845 was called to the bar. From 1849 to 1860 he was attorney-general of St. Kitts (in the West Indies), a member of the executive and legislative councils of that island, and for some time acting chief justice. In 1860 he was transferred to Western Australia as civil commissioner and chairman of quarter sessions and next year became chief justice. He died on 21 December 1879. (Kt. Bach., 1873.)

Burton, SIR WILLIAM WESTBROOKE (1784-1888), born at Daventry in England on 31 January 1794 and educated locally, entered the navy in 1807, saw service in the Mediterranean, on the East Indies station, and off the coast of North America; he was wounded during the blockade of Toulon in 1811, and took part in the fight off New Orleans in 1814. The subsequent peace seemed unlikely to provide excitement or promotion; so he left the navy to study law (his father's profession), and in 1824 was called to the bar at the Inner Temple. In 1826-7 he was recorder of Daventry, and in 1828—having devoted some time to the study of Roman-Dutch law—was made a judge of the supreme court of the Cape colony. Transferred in 1832 to New South Wales, he was sworn in as judge of the supreme court there on 22 December. His term on the bench was notable for two important decisions—the one (provoked by his claim to be senior to Judge Dowling) that the supreme court of the colony was a body distinct from any other British court, and that previous appointments to other benches did not carry with them seniority in New South Wales; the other, the fruit of his own persistence, enforcing a neglected rule that barristers only should be heard in court, whereas solicitors had hitherto illegally enjoyed the right of audience. In 1844 he was transferred to the supreme court of Madras, thus missing by a few weeks his excellent chance of becoming chief justice of New South Wales at the death of Sir J. Dowling. Soon after his arrival in India, becoming chairman of the Madras Indian Emigration Society, he initiated a movement for sending Eurasians to Australia as colonists; Henry Parkes, at that time editor of the *Empire* and confronted with a strike among his compositors, arranged with Burton for the supply of 25 to 30 Eurasian compositors; but the experiment was not repeated. In 1857 Burton retired on a pension and returned as a private citizen to Sydney, was immediately nominated a member of the legislative council, and on 9 February 1858 became its president. In 1861, however, the council having rejected John Robertson's land bill, it became known that 20 new members were to be nominated to that body for the purpose of carrying it. When the 20 were assembled outside the chamber to be summoned, Burton announced from the chair that he heard that certain persons were waiting to be sworn in, but had had no official intimation of their nomination; regarding this as an insult to the house and the chair, he intended to resign, and would at once leave the chair—which he did, followed by 19 other members and making it impossible to form a quorum. The result of this action is narrated under WENTWORTH, W. C. It made Burton's renomination to the council (whose term expired three days later) impossible; he therefore left the colony, retired to private life in England, and died on 9 August 1888. Both at the Cape and in New South Wales he is remembered as a useful and upright judge, whose presence on the bench ensured public confidence and respect. He was the author of two publications, one (1842) on the insolvency laws of the colony, the other (1840)—which provoked an answer from Dr. Ullathorne—*The State of Religion and Education in New South Wales.* (Kt. Bach., 1844.)

Busby, JAMES (1800-1871), born in Scotland on 7 February 1800, was the second son of John Busby, for whom see below. In 1822 he visited the vineyards of the Bordeaux district in France, and on arrival in New South Wales with his father in 1824 compiled a *Treatise on the Culture of the Vine* which was published by George Howe, the government printer, in 1825. Brisbane, to whom it was dedicated, at once set the author to experimenting with the agricultural establishments for convicts that had been recommended by J. T. Bigge, and in December made him manager of the estate whose revenue supported the boys' orphan school, Busby agreeing to teach the boys vine-culture in return for one-third of the farm produce. The trustees of the clergy and school lands corporation, when in 1826 they took over the estate, dismissed Busby and closed down the farm, thereby initiating a long quarrel about his claim to his share of the produce, which in the end he recovered from the colonial government. Darling promptly made him collector of internal revenue—a new office, which he had to organize from the start—and employed him on the land board and on many boards of enquiry; when in 1829 he was superseded as collector by a nominee from England, he devoted himself to land board work, but in January 1831 refused Darling's offer of the secretaryship to the board, and proceeded to England in February to press a claim for compensation. In 1830 he had published a second book on vine-culture, the *Manual of Plain Directions*; after visiting London he went off to Spain on 6 September, traversed the vine-growing districts from Cadiz to Malaga, and those of France from the Pyrenees to Champagne, and obtained at Montpelier 437 vine-cuttings and at Paris 133 more (570 varieties in all). These he presented through the colonial office to the Sydney botanic garden, where in January 1833 362 were alive. In March 1832 he handed over 540 cuttings from Spanish vineyards, including raisin, dessert, and wine grapes, and a collection of seeds and fruits of the date, pumpkin, tomato, cucumber, onion, melon, and sweet pepper. This assiduity, combined with the intelligence he had shown as a witness before a parliamentary committee on secondary punishments, led Goderich—then col-

onial secretary—to appoint him resident in New Zealand. In June he left England for his new post, taking with him a letter addressed by Goderich to 'the Chiefs of New Zealand' and an order on Bourke for the supply of presents 'of inconsiderable value' for those chiefs. A warship conveyed him to New Zealand, but once there he was left to the protection of moral influences only. On 16 May 1833 he reached the Bay of Islands and inaugurated an administration sufficiently described under NEW ZEALAND.

In 1839 the New South Wales authorities urged on the colonial office that Busby's salary should no longer be a charge on the colony, since it derived little advantage from his work in New Zealand. It had, however, been already decided in London to abolish his position as resident, and on 29 January 1840 William Hobson (q.v.) reached the Bay of Islands from England with a commission appointing him lieutenant-governor of New Zealand. Busby gave Hobson loyal and unremitting support, revising for him the draft treaty of Waitangi (which was discussed and promulgated at Busby's house) and obtaining the signatures of important chiefs. With the intention of settling permanently in the island he had bought from the Maoris in strict accordance with their customs a block of 40,000 acres of grazing land at Whangarei and another of 10,000 acres of timber land near Auckland, and had erected a sawmill on the second block. Visiting Sydney to buy cattle, he was astonished to find that Gipps —disgusted by Wentworth's attempt to assert possession of 20 million acres in South Island on very flimsy pretexts—was pushing through the legislative council a bill that cancelled all existing titles of any sort to New Zealand land. Despite Busby's endeavours—on 30 June 1840 he addressed the council at great length on the subject—the bill was passed, though afterwards it was disallowed by the colonial office because, before it could be ratified, New Zealand had been made a separate colony. Busby returned to the Bay, could get no satisfaction from Hobson, went off to England to press his claims, and came back in 1846 unsatisfied to settle down on what land was left to him and maintain close relations with the missionaries. From 1850 to 1860 he poured forth a stream of pamphlets on local problems, especially (in 1857-60) on the difficulty of establishing truly responsible government in a discordant and half-Maori community. He had never renounced his claim to the land taken from him, and in 1864 went back to England to make further attempts to gain, if not the land, at least compensation for the loss of it. Eventually he was awarded £36,800 by arbitrators appointed in New Zealand. The government, not having so much spare cash, paid him with scrip that would be accepted, it said, at its face value in payment for any crown lands on sale in the province of Auckland—whereupon, according to Busby's story, the superintendent of lands promptly withdrew from sale every block of land in the province that was of any value. While on a visit to England undertaken in the hope of removing this final obstacle, Busby died in July 1871.

Busby, JOHN (1765-1857), born at Alnwick in Northumberland in 1765, was trained by his father, a coalmaster, to his own business, and was at the age of 19 manager of a coalmine. Gradually developing special skill in mine-locating and surveying, he adopted the profession of mineral surveyor and civil engineer, worked for three years on the Downshire estates in Ireland, and settled in Scotland, where he surveyed several counties for minerals and water and was employed on many important public works, including the water-supply of the fort at Leith. In some way (probably through the Downshire interest) he came under the notice of J. T. Bigge, who recommended him to the colonial office as a fit person to supervise coal-mining at Newcastle and devise a satisfactory water-supply for Sydney. He was accordingly engaged in March 1823 for a three-year term at £200 a year, with the right of private practice 'outside 200 days in each year;' if he was found useful, he might be granted a block of land and retained for two years more. If he chose to devote his whole time to public business, a house would be provided for him. So valuable were his services expected to be that Brisbane was instructed, if Busby considered Tasmania outside his contract, to make special terms with him for an investigation of the island's mineral resources. Moreover, he received extra pay for any days worked over 200 a year, and on one occasion at least received in addition to his salary a large reward for re-floating a government vessel.

On his way out he stayed for a short time in Tasmania to investigate deposits of coal that had been reported from Coal River and Schouten Island: his opinion of the island coal was very favourable. He reached Sydney on 24 February 1824, was at once sent off to superintend mining operations at Newcastle and to construct a breakwater there, and then spent eight months in salving the government brig *Elizabeth Henrietta*, which had gone ashore on a New Zealand beach. But his most important work was the construction of Sydney's first regular water-supply. In 1825 the town depended on (*a*) private wells, (*b*) the tanks at the corner of Hunter- and Pitt-streets, (*c*) water brought in barrels from the Blackwattle swamp on the west and the Lachlan and Botany swamps on the south. Busby's first proposal was to pump water from the swamp at Waterloo to a reservoir in Hyde Park, driving the pump either by steam-engine, a water-wheel, or a treadmill propelled by convicts; he favoured the water-wheel. The colonial office characteristically found the treadmill proposal the only part of his scheme that it could thoroughly approve; Bathurst thought it an excellent idea to spread among possible criminals in England the news that transportation might involve consignment 'for years together to labor in the Tread Mill.' But in 1826 Oxley and Dumaresq concurred in a new suggestion of Busby's, that 'driving a Mine the whole way' would bring the water into Sydney at a level high enough to supply most of the town, and a small water-wheel at the town end would pump enough to supply the rest of it; and in September 1827 the work was begun. Darling valued Busby's work highly, and proposed to increase his salary to £500 a year with allowances, but the colonial office was restive about the cost of the settlement, and had been receiving from an aggrieved person named E. S. Hall (editor of the *Monitor*) charges of favouritism and extravagance against Darling, which included the statement that Busby and his sons were drawing about £1600 annually of government money. So Darling had to compromise on £500 a year without allowances, at the same time assuring the authorities in London

that it was quite impossible to dispense with Busby's services until the water-supply was in working order. Unfortunately the excavation by convicts of a tunnel 12,000 feet long and only five feet high was likely to be slow in completion if not continuously and thoroughly supervised; moreover, unexpected deviations became necessary to avoid quicksands in one locality and a bed of pipeclay in another. Busby, too, was growing old and infirm, so that Bourke insisted on the employment of his son William Busby as overseer, the salary being divided between father and son. Even so the tunnel (which is still in existence) was not completed until June 1837, although from 1830 onwards there had been a flow of water from it at the Hyde Park end, due to percolation through the strata in which it was bored. The Hyde Park reservoir was never constructed, the water being supplied to users through a standpipe. 'Busby's bore' sufficed for the needs of Sydney until 1849. When Busby retired on 30 June 1837, he received a gratuity of £1000 and a grant of 2000 acres on the Hunter between Branxton and Singleton; there he settled, and died on 10 May 1857.

His youngest son WILLIAM BUSBY (1813-1887), after completing his work on the tunnel, took up pastoral pursuits in the neighbourhood of Cassilis. In July 1867 he was nominated to the legislative council, and was a member until his death on 23 June 1887. An elder son, James Busby, is treated of separately above.

Bush Canary. See FLY-EATERS AND TREE-TITS.

Bushranging. Occasional cases of highway robbery occur to this day in Australia as in other countries. But in Australia the systematic practice of highway robbery, usually by small gangs, flourished exceptionally during two epochs, and was revived in unusual circumstances during a third. These three epochs must be carefully distinguished. In the first the robbers were convict escapees: in the second they were usually free men of an adventurous and lawless type, tempted by rich convoys of gold: the third epoch was concerned entirely with the doings of a single gang, the Kellys.

The name 'bushranger' with its variants 'bush-ranger' and 'Bush Ranger' seems first to have been used for the convict escapees about 1806; the *Sydney Gazette* of 4 May in that year uses it as a term needing no explanation. But the term then connoted their life in the bush rather than their habit of robbing, and was for many years used also of free and reputable men who spent most of their time in the bush. Thus as late as 1825 W. H. Hovell (q.v.) is described in the *Australian* as lacking 'all the qualities befitting a bushranger.' In Tasmania the escapees were at first called 'bolters.'

Convict bushrangers.—The first bushrangers were convicts who had escaped from assigned service, or from the road-gangs, and took to the bush to avoid recapture. Not finding in the bush much that they could live on, they were compelled to resort to robbery for mere sustenance: Bigge defines bushranging as 'absconding in the woods, and living upon plunder and the robbing of orchards.' Obviously the quality of the crime, apart from the actual absconding, depended on the character of the escapee, and Tasmania, being the gaol of twice-convicted and specially refractory convicts, produced the earliest and most violent bushrangers. Bligh in 1807 was 'much concerned' about the bushrangers who were annoying Governor Collins, and in 1809 reported that some of the crew of the *Porpoise* had joined a body of 60 bushrangers who were infesting the roads inland. Collins in 1807 offered an amnesty to those who would surrender, but early in 1808 had to prohibit the passage of boats across the Derwent because two notorious bushrangers (Lemon and Brown) were at large in the woods beyond. In March, however, Lemon having been killed and Brown captured, the embargo was taken off. Macquarie, who visited Tasmania in 1811-12, was deeply impressed with the need for destroying the gangs, but hoped to effect a good deal by means of another amnesty, which he proclaimed on 14 May 1814. A year's trial proved this policy useless, and Macquarie ordered Davey (his lieutenant-governor) to pursue the gangs with specially mustered parties and to offer rewards for their capture. Davey found even these measures ineffective, and of his own accord proclaimed the establishment of martial law in the island—an act for which Macquarie never forgave him.

Among the bushrangers mentioned by name in Macquarie's amnesty offer were Michael Howe and John Whitehead, the latter of whom had for some years been leader of a notorious gang. Both took advantage of the offer, and both within six months were back in the bush, collecting new accomplices and raiding the settlers on both sides of the Derwent. Before the end of 1815, however, Whitehead had disappeared—his fate is more fully discussed under HOWE, MICHAEL—and Howe became leader of the gang; he established almost naval discipline among his followers, raided the northern and southern settlements indiscriminately, and even corresponded as 'governor of the rangers,' with Sorell as 'governor of the town.' He was killed in 1818, most of the gang having been captured or killed before him, and the colony had a few years' quiet. But the establishment in January 1822 of a penal settlement at Macquarie Harbour on the west coast, where discipline was extremely severe and escape, though very difficult, not impossible, resulted in a revival of bushranging. Some prisoners escaped by land, suffering great hardships: the most notorious was Pierce the cannibal (1822-3). The principal gang was that of Matthew Brady, an educated man who had been transported to New South Wales for forgery and sent to Tasmania for insubordination. With twelve companions he stole a boat at Macquarie Harbour on 7 June 1824, landed nine days later near the mouth of the Derwent, and for nearly two years raided the settled districts from Launceston to Sorell. Brady forbade unnecessary violence, boasted that he never killed a man intentionally, severely punished members of the gang who were brutal to women, and was on the whole the least inhuman of Tasmanian bushrangers. In 1826 his gang was betrayed and broken up, and he himself captured by John Batman: by the end of April the last of the gang had been despatched, and the island thenceforth had comparative peace, though in 1832-3 a small gang (Britton's) infested the northern settlements, and in the early forties Martin Cash (q.v.) with two companions committed many robberies in central Tasmania.

The first act that could be called bushranging in Australia was a highway robbery reported by David Collins under the date June 1794: Collins considered it 'one step towards refinement' and 'at least a manly method of taking property.'

But serious bushranging on the mainland did not commence until 1822, when 34 bushrangers were hanged. In 1824 the raids of escapees occasioned the proclamation of martial law west of Mount York from 14 August to 11 December, and in the following year Brisbane was forced to take vigorous measures against them, both legislative and administrative. In 1826 a gang of seven had a fight with police near Bathurst, and in 1827-30 Donohoe and Underwood harried the Hawkesbury-Nepean settlers from Windsor to Bringelly. This was the 'bold Jack Donahoo' of the old bush song—which must not, however, be regarded as historical, since Donohoe was killed by a settler, not by the 'horse police.' Underwood is said to have been killed by his mates when they discovered he was keeping a diary of their robberies—an obvious prelude to turning King's evidence. In 1830 the evil had become so great that the legislative council passed a bushranging act almost unique in its severity. Among other things it provided that all suspected persons might be apprehended without a warrant: that anyone carrying arms might be arrested, and anyone suspected of having arms might be searched: that, if provided with general search-warrants, the police might enter or break into any house by day or by night, seize firearms found therein, and arrest the inmates. When convicted, robbers and housebreakers were to be condemned to death, and executed on the third day thereafter. The necessity of such an act was shown almost immediately by an outbreak near Bathurst in September 1830, which almost assumed the proportions of a convict rebellion. At first, it is said, nearly 80 convicts joined the gang, but after a week or two it had dwindled to 13 well-armed and desperate men, who beat off a body of settlers and two detachments of mounted police before they were captured by a company of the 39th regiment. The provisions of the act were rigorously enforced, and for some years bushranging died down, but revived again in 1839-42: it would appear that there was always a supply of potential criminals, but they needed a lead. This was given by John Lynch, the most callous of New South Wales bushrangers, who is believed to have committed at least nine murders before he was hanged in 1842 at the age of 29. Of a very different type was William Westwood (Jackey Jackey), who had been transported in 1837, when only 16 years old, took to the bush in the Goulburn district in 1840, and for some time robbed mail-coaches on the Bungendore road. Growing more daring, he frequented the main southern road, and even visited Sydney, but in 1841 was captured, sentenced to penal servitude for life, and after an attempt to escape from Cockatoo Island sent to Port Arthur. He escaped, but was caught in Hobart and sent to Norfolk Island: there in July 1846 he headed a riot, killed four policemen, and was hanged on 13 October, when only 26 years old. For many years later his memory was treasured by the 'old hands'—ex-convicts employed, after the abolition of transportation, on outback stations. Among the minor bushrangers of this period may be mentioned Comerford and Dignum, who in 1837 took to the bush from Yass and harried settlers in the neighbourhood of Melbourne: McKewin or McKeown, who levied blackmail on farmers near the Jenolan Caves (q.v.): Edward Davis, the 'Jewboy,' whose gang haunted the Hunter River valley in 1839-40, and were all hanged together in February 1841: and Scotchey and Witton, who in 1842-4 infested the Lachlan and Crookwell districts. Wilson and Green in 1839-40 raided the settlements east of Gawler in South Australia, and a gang headed by John Ellis ('Yankee Jack') had a short but exciting career in the Dandenong ranges in 1842. But by the forties settlement along the main roads was fairly continuous, a good deal of police protection was available, and the rewards of successful bushranging were not large enough to compensate for the ever increasing risks.

The Gold-robbers.—The discovery of gold—especially in New South Wales, where the diggings were widely scattered over distant and sparsely settled areas—completely altered the balance between gain and risk. In 1850 Sydney and a few small country towns—Bathurst, Goulburn, Maitland, and one or two others—were each the nucleus of a farming district, in which no settler was at a very great distance from his neighbours. The portable wealth of the country concentrated in these areas was easily defensible: the only line along which it could be easily attacked in transit was the line of road which connected Bathurst with Sydney by way of the Blue Mountain passes. By 1853 the whole face of the country was changed. Its wealth now came from out-of-the-way gullies or from crown lands never before opened up, and only connected with civilization by long, devious, and often dangerous tracks. In the western district of New South Wales alone, where there had been one critical point—Mount Victoria Pass—there were now half a dozen: from Ophir, from the Turon, from Louisa Creek, from Forbes and from Lambing Flat a few years later, the roads along which thousands of pounds worth of gold had to be sent climbed five-mile-long hills, wound through dense scrubs, and in one way or another exposed their traffic to unforeseen and hardly resistible attack. Settlement, too, had spread into the wilds, and small farmers maintained themselves with much struggling in half a hundred gullies among the foothills of the main range. It was among their sons, to a large extent, that the new school of bushrangers recruited itself. Convicts, or men who inherited the convict tradition, first revived the profession of highwayman: but soon there gathered round them the 'wild colonial boys' of the old song, young fellows with a taste for adventure and no great love of work, in whose training the moral element had been entirely left out. They saw miners making fortunes more by luck than by skill or foresight, and they took what seemed the easiest way of sharing in that lightly-won wealth. To stick up a mail-coach or a bank had a spice of adventure in it—and Australians were never wanting in pluck. And after all, the money they took (so they argued) was easily replaced; if to-day a Lambing Flat tradesman found himself the poorer by a few hundred pounds, it would take him no long time to fill his purse again from the earnings of his digger-clients.

This advent of the free-born bushranger produced new relations between the criminals and their fellow-countrymen. The banditti of the fifties and sixties had no need to skulk round outlying settlements, seeking refuge in caves or in lonely station-huts. Their refuge was ready to hand among their friends: the whole countryside was often in league with them; the coming of their natural enemies, the police, was known to them miles away by means of a

well-organized system of 'bush telegraphs.' Two things they stole—gold, from the townsfolk, because it was portable wealth: horses, from the squatters, to be the instruments of attack and of escape. In no way did they injure the small farmer class from which they sprang. They worked in gangs, well organized, carrying on several raids at once, or combining at a given moment to make a great stroke and then dispersing as rapidly to widely separated haunts. The police found themselves baffled and betrayed time after time by the very men whose interests they were trying to defend. For mounted constables represented the law, which is never really popular in half-settled countries: they represented property, which those who have none always look upon as fair game; they stood for the government—and the young Australian, more especially, has a preference for being 'agin the Guvnment.' On the other hand, the bushranger stood for pluck, and daring, and the bush ideal of romance: and so strong was his hold on the hearts of those who did not suffer directly at his hands that, whereas the townsfolk of Bathurst and its congeners were to a man for law and order, no small proportion of the townsfolk of Sydney was ever ready to join in petitions for the reprieving or release of some bandit hero. Such a one stood, as has just been said, for pluck and daring: yet it is part of the paradox of Australia that in no profession were true pluck and true daring so little needed. Nowhere else in the world could so much wealth have been won with so little real risk to life. Looming in the distance, no doubt, there was always the gallowstree, or the disabling and torturing rifleshot: but how easily these things could be avoided was proclaimed to everyone by the career of Frank Gardiner (q.v.), king and exemplar of all goldstealing bushrangers. Times without number he was either captured or surrounded by the police; but either his guards could be bribed, or his high official captor, in the moment of triumph, did something ineffably foolish, or—when at last he had been tracked to a quiet home in Queensland, and caught, and tried (though for one of his minor offences only), and consigned safely to perpetual gaol—mysterious influences stirred the heart of premier and governor, and Gardiner went free to America to live out cheerful days.

How mild were the manners with which a bandit could do profitable trade the curious will learn by studying the career of Ben Hall's gang. This was the great gang of the bush-ranging sixties; it raided even Bathurst, then the second town of the colony; it stuck up gold-escorts innumerable, and fought long fights with ardent police; it besieged a magistrate in his own homestead, and held him to ransom—thereby creating one of the two favourite Australian melodramas, that deals with the romance of Mrs. Keightley's ride to save her husband's life. From end to end of the western tablelands of New South Wales men may travel to-day through the places it made memorable—the 'notorious Wombat;' Bang Bang, so called long before three bushrangers and a couple of police constables exchanged forty shots at about as many yards and hit nothing between them but a hat and a bar-room; Canowindra (which is pronounced 'Canoundra'), the bush township that five of them held for three days, issuing written passes to people who wished to go out of town for dinner; most famous of all, the Weddin Mountain, haunt and refuge of all western outlaws, amid whose tangled gullies and baffling scrub the police time after time sought their prey in vain.

From first to last this gang included six men only, of whom the leader was but 25 years old when he took the lead, and the others ranged from that age down to 17. Of its exploits a very few have been mentioned above: its reputation may be guessed from a satirical paragraph that appeared in 1863 in *Bell's Life in Sydney* 'NARROW ESCAPE OF THE POLICE! ! !' it was headed. 'Last evening three bushrangers espied a large body of troopers, and immediately gave chase. The darkness of the evening favoured the escape of the troopers, and baffled the bushrangers. The appetites of captain McLerie and Sir F. Pottinger'—two police-superintendents—'continue in undiminished vigour.' Perhaps the most astonishing incident in the gang's career took place at the end of 1864. Two of the bushrangers had by this time been shot during attacks on stations, and one had surrendered himself by the advice of a Catholic priest: the three who were left had temporarily abandoned the western district, and were overhauling mail-coaches on the main road that connects Sydney with Melbourne. One day in November they set to work in grim earnest. They stationed themselves on a hill near Jugiong (a small hamlet on the upper Murrumbidgee), and soon collected about 60 prisoners. Everyone who came by was 'stuck up,' robbed, and forced to sit down in the bush out of sight of the road. This haul alone provided nearly £100: but the gang had bigger game in view. Presently a mounted policeman came along. He was ordered to surrender: when he refused, the three outlaws rode at him, firing. They fired nine shots, he fired six, but nobody was hurt: then he took his place with the 60, who had not stirred from their place of imprisonment. At last came the great prize, the overland mail-coach, with a constable as mail-guard and two more as escort (one of these was a sergeant and the other a sub-inspector, so they were picked men). Shots were exchanged: the sergeant was killed, the sub-inspector surrendered, the mail-guard ran away, and a police-magistrate, who was a passenger, helped to throw the mailbags out of the coach for ransacking. The 60 captives, guarded by one man—for two 'stuck up' the coach—remained passive, though some of them seem to have come out of the bush to watch the fight. When it was all over, Gilbert (the actual murderer) walked over to look at his victim's body. 'I'm sorry for him' he said, 'he was a brave fellow: I don't like to shoot a man, and he's the first man I ever shot.'

It is an incredible story, but true in every particular. Gilbert had been Gardiner's right-hand-man before he joined Ben Hall: yet he had never shot a man before. Three men terrorized 60 people on the open road, and not one made an attempt to escape. One man kept those 60 people impotent while his two friends were engaged with the police and the mail-coach. Yet the victims were presumably not all cowards, and men of their stamp were not slow to defend their own homes when a larger gang made night attacks. The fear of treachery seems to have been responsible for their conduct. The bushranger, as has been said above, was hand in glove with many small farmers and their kin, and no one of the 60 could be sure that his next neighbour was a *bona fide* prisoner. And the tales of oldtime bushrangers stood their successors in good stead; the

traditional reward of any attempt to escape was death. So Gilbert, who had never till that day killed a man, lost none of his terrifying power by that abstinence: he was feared as the successor, and possible rival, of Donohoe the stripper and Jefferies the woman-murderer. When men defied the robbers boldly, they were often allowed to go unharmed past their less fortunate fellows. Not long after the Jugiong affair the same three were holding the same main road not many miles out of Goulburn, between that town and Sydney. A coach and several drays had been 'stuck up,' besides the usual miscellaneous crowd of passers-by. Then came along William Macleay in a buggy; seeing the bushrangers, he told his boy to drive slowly on, while he walked by the horse with a loaded rifle in his hand. The gang at once rode off into the bush, and did not disturb him until, half a mile farther on, he got into his buggy again: then they fired a couple of shots, but disappeared again directly he returned their fire. Yet not even this proof of their desire for a peaceful life could destroy their reputation for bloodthirstiness; Macleay actually stopped on his road to talk to the prisoners, but found them too cowed even to answer him, much less to make any attempt at escape.

It is at first sight remarkable that so quiet and profitable a trade was ever given up. Yet in the end nearly every man engaged in it died by violence—a few executed, most shot down in the bush by police or amateur trackers. For, one and all, they made the fatal mistake, grew careless of human life, began to kill recklessly, and so exasperated the police into energetic pursuit. Ben Hall's gang for 2½ years found the police quite harmless, and baffled or evaded them with ease and a good deal of pleasant humour: nor did the shooting at Jugiong much disturb these relations. But when, early in 1865, one of the gang shot a constable at Collector, and within six weeks or so four others were wounded in skirmishes, the temper of the police changed. Then tracking began in serious earnest. Then we hear that 'the bush was alive with police' about their haunts. By the middle of May both Gilbert and Hall had been shot, the latter receiving volley after volley from his pursuers—they admitted having fired thirty shots, and fifteen were found in his body.

The career of Hall's gang has been discussed at length because it illustrates clearly the attitude of the public at large towards bushranging when not combined with brutality. We must now return to a more chronological narrative. The gold-robbing epoch began, as might have been expected, in Victoria, where ex-convicts from Tasmania found profitable employment on the roads from Buninyong and Bendigo to Melbourne; one daring trio even boarded a vessel (the *Nelson*) in Hobson's Bay and stole from her 8183 oz. of gold, and another in 1854 took over £15,000 from the Bank of Victoria at Ballarat. The most notorious of these Tasmanian criminals was Frank McCallum (q.v.), better known as Captain Melville. But distances were short in Victoria, and in a few years police protection along the main roads was ample, while the small farmer class from whose families the most notorious gangs of this epoch were recruited hardly existed in the southern gold-bearing area.

In New South Wales the epoch began with the exploits of Frank Gardiner, which are related under his name. Both he and his first companion John Piesley were 'colonially convicted' men: so was John Gilbert, Gardiner's right-hand man after Piesley was hanged on 25 March 1862: but the recruits who joined Gilbert after Gardiner had escaped to Queensland—Ben Hall (q.v.), John O'Meally, John Dunn, Michael Burke, John Vane—were either themselves respectable farmers to begin with or the sons of such men. O'Meally and Dunn were mere boys when they joined the gang. Raids and robberies innumerable were attributed to the Gilbert-Hall party, their names being used by every amateur highwayman who 'bailed up' a solitary traveller. Their chief exploits, however, are well authenticated, and included the theft of well-known race-horses from half a dozen stations in the Lachlan valley, raids on Carcoar, Caloola, Trunkey, Canowindra and stations in the vicinity (all during the autumn and winter of 1863): the famous visit to Bathurst on 23 October, undertaken simply because a young Bathurst resident had dared them to go there: the attack, already mentioned, on Keightley's house near Rockley, in which Burke was killed and after which Vane surrendered: a raid (19 November 1863) on Goimbla station near Forbes, in which O'Meally was killed: and then, in the spring and summer of 1864-5, a long series of mail-robberies and 'stickings up' on the roads west and south of Goulburn. This long-lasting impunity, and the complete failure of the police to inflict any injuries on the gang (for Burke and O'Meally were killed by settlers whom they were attacking), drove the government to pass hastily through the Sydney legislature a felons' apprehension act (12 April 1865), under which bushrangers might be proclaimed outlaws and killed at sight if they would not surrender, and all who harboured them or aided them with information or otherwise became felons. On 10 May Gilbert, Hall and Dunn were so proclaimed. But Hall had already been killed on 5 May near Forbes: Gilbert was betrayed by Dunn's grandfather and killed on May 13: Dunn, who was wounded when Gilbert was killed, but escaped to the lower Macquarie district and for eight months worked as a horse-breaker, was caught near Dubbo early in January 1866 and hanged on 19 March. From February 1863 to April 1865 this gang had committed 10 mail-robberies, stolen 23 race-horses for its own use, raided 21 stores and private houses—and killed two men.

A bushranger of a very different type was Daniel Morgan, who was active in the southern districts of New South Wales, along the Murray while Ben Hall's gang was harrying the centre. Though never a convict—he was born at Campbelltown in New South Wales in 1830 and from 1847 to 1854 was a stockman on a Murrumbidgee station—he rivalled the worst of the convict bushrangers in brutality. He shot down unarmed and sleeping men, and tortured women. His criminal career began near Wagga soon after the Eugowra robbery, included raids on stations and isolated inns between Tumberumba and Deniliquin, and ended when in the autumn of 1865, in response to a challenge from the Victorian police, he crossed the Murray and held up traffic and station-owners between Wangaratta and Benalla. On 8 April he visited Peechelba station, some 15 miles NW. of Wangaratta, bailed up the entire household for the night, and was shot next morning by a station hand. His head was cut off and sent to Melbourne to be examined for scientific purposes by the university's professor of physiology.

The Clarke brothers operated between Goul-

burn and Monaro in 1865-7. Their family history is remarkable. The father died in gaol while under arrest for shooting a black tracker. Of four uncles, one was shot by police in a raid, two were convicted of highway robbery, and the four were accessory to a murder of policemen. The family lived by cattle-duffing and horse-stealing until the police tried to arrest them, and then took to bushranging. The second brother, James, was convicted of receiving property stolen by the Ben Hall gang in a mail-robbery. Thomas, the eldest, escaped from Braidwood gaol—to which he had been committed on a charge of robbery—early in October 1865, and within the next eight months stole three race-horses, robbed a post-office, three stores, and many travellers on the roads between Braidwood and Moruya, stuck up the Araluen mail, and killed a policeman. At the end of May his youngest brother John joined him in the bush, and the pair in 11 months stuck up six mail-coaches, robbed travellers innumerable (most of them Chinese), and killed four special constables. They were not always alone in these crimes: Patrick Connell, an uncle, frequently accompanied Thomas, and in the later months William Scott and James Griffin were members of the gang: Scott was killed by the Clarkes, and Griffin seems to have betrayed them. After Thomas Clarke's murder of the policeman on 9 April 1866 he and Patrick Connell were proclaimed under the felons' apprehension act: and after the murder of the special constables on 5 January 1867 a reward of £5000 was offered for their capture—a distinction which they promptly celebrated by sticking up four mail-coaches within a fortnight. On 27 April, however, they were surrounded at night in a settler's hut by 15 troopers and in the afternoon of the next day surrendered without a struggle. They were tried in Sydney, and hanged on 25 June.

Isolated cases of bushranging continued to occur for several years after the execution of the Clarkes, but few are worth notice. The best-known of the later criminals was Frederick Ward ('Captain Thunderbolt') an ex-convict born at Windsor, New South Wales, who from December 1864 to May 1870 lived at large upon the area from Newcastle north to Manilla, robbed many mails and stuck up many travellers, and was shot on 25 May: he is usually reckoned the last of the New South Wales bushrangers. In 1873 an official return showed that 23 men were in gaol who between 1864 and 1869 had been sentenced to various terms for highway robbery. The other colonies were less troubled. In Queensland only one 'professional' bushranger appeared—Alpin Macpherson, better known as the 'Wild Scotchman,' who in the early sixties alleged that he had been a member of Ben Hall's gang, but in fact did very little except stick up half a dozen travellers, allow himself to be captured, escape from custody, and get caught again. In Victoria, after the capture of McCallum, the only bushranger of note was Harry Power, an Irishman who reached Victoria at the beginning of the gold-rush, took to horse-stealing in 1855, was gaoled therefor and served the greater part of a 14 years' sentence, but early in 1869 escaped and took to the bush in the Beechworth district. Except for a short raid into New South Wales as far as Adelong, he confined himself to this area, and was captured in his camp near the head of the King River on 27 May 1870. He served out a 15 years' sentence, was engaged after his liberation to add verisimilitude to the exhibition at Melbourne and Sydney of the pseudo-convict hulk *Success*, and was drowned in the Murray during a holiday trip on 7 November 1891.

From 1870 onwards Australia was on the whole free from bushrangers for about eight years. Then, out of a clear sky, there burst upon Victoria the first of the astounding feats of the Kelly gang. Ned Kelly, the leader of this gang, had consorted with Power, who thus became a link between the bushrangers of the sixties and the solitary eruption of the late seventies. For the history of the Kelly gang see KELLY, EDWARD. Here we need only note that its appearance and exploits were an isolated and extremely melodramatic phenomenon: they afforded, indeed, the material for the second purely Australian melodrama, of which Ned Kelly is the hero. But no possible stage production could equal the sensationalism of the gang's actual last moments, when they were trapped in the inn at Glenrowan. The leader, walking calmly among his enemies in impenetrable armour, fired on for half an hour by ten of them, and brought down at last with four wounds in the legs—which he had neglected to armour: his two desperate comrades, answering sullenly from their refuge the fire of 50 police concentrated on the little weatherboard hotel: the crowd of spectators, mainly sympathizers with the gang, and including one of the Kellys' sisters: the demands of the baffled assailants for a 12-pounder cannon and an electric searchlight: the final catastrophe, when the building was set on fire, and among its ashes were found the bodies of the two defenders, so burnt as to be hardly recognizable for human remains—the crudest of Elizabethan playwrights could have conceived nothing more bizarre. In such fire and fury perished the last of the bushranging gangs, and left to Australia traditions of adventure that might have been dangerously attractive, had not the brutal lives—and deaths—of most of the pseudo-heroes robbed them of their glamour.

See Boxall's *History of the Australian Bushrangers* (1924 edition) and Charles White's *History of Australian Bushranging* (1906).

Bustards. birds of the family Otididae, inhabiting open country throughout the old world. The Australian species, *Eupodotis australis*—which is almost universally known as Wild Turkey or Plain Turkey—is widely spread over the continent, particularly in the inland districts, but does not occur in Tasmania.

The bustard feeds largely on insects, especially grasshoppers, so that it is of great value to the agriculturist. By destroying these insects in their inland nurseries it probably often prevents the formation of large swarms which, when once formed, would undoubtedly travel towards the cultivated coastal regions in search of food. Unfortunately, its fine edible qualities make it much sought after by sportsmen, and its terrestrial habits render it a comparatively easy prey to the fox, which makes numerous captures of sleeping birds. It is rapidly becoming rare in all settled districts.

The cock bustard attains a large size, sometimes weighing as much as 18 lb. When displaying before the hen he behaves much like a domestic turkey-cock, elevating his tail like a fan, spreading his wings, erecting the long crest feathers on his head, and inflating with air a sac in the throat so as to spread out the elongated feathers on the front of the neck. The female lays one reddish-brown, mottled egg on the bare ground; occasionally two are laid.

These fine birds were first met with by Captain Cook on 23 May 1770, on the Queensland coast a little north of the present town of Bundaberg; 'upon the shore' he notes 'we saw a species of the bustard, one of which we shot, it was as large as a turkey and weighed 17½ pounds. We all agreed that this was the best bird we had eaten since we left England

Wild Turkey.

and in honour of it we called this inlet Bustard Bay.' Incidentally the presence of bustards on the coast indicated that the area farther inland was at the time drought-stricken; in normal years the bustards are not found on the coast.

W.B.A.

Butcher-birds, perching birds belonging to the genus *Cracticus,* confined to New Guinea, Australia, and Tasmania. The genus was formerly placed in the family Laniidae (shrikes), to which the butcher-birds in other countries belong, but is now generally recognized as closely related to the Australian magpies (*Gymnorhina* and *Strepera*), and is placed in the family Streperidae.

Butcher-birds are largish birds (though smaller than magpies), with handsomely marked black, white, and grey plumage and stout bills with a hook at the end of the upper mandible. They feed on large insects, lizards, mice, and young birds, and derive their name from their habit of hanging up the bodies of any victims which cannot be swallowed immediately by sticking them on spiny twigs in some convenient tree.

The nests of butcher-birds are large, open, cup-shaped structures placed in bushes or small trees, and the three or four eggs are yellowish-brown in ground-colour, with brown spots and blotches. The commonest species throughout southern Australia, and the only one found in Tasmania, is the Collared Butcher-bird (*C. torquatus*), whose cheerful, rollicking call bears a slight resemblance to the laugh of the kookaburra, though it is much more melodious; this has given rise to the name of little or Derwent jackass by which the collared butcher-bird is frequently known.

The larger and handsomer Black-throated Butcher-bird (*C. nigrogularis*) is found through-

Black-throated Butcher-bird.

out the greater part of the continent, but is more partial to the inland districts. The other three species are confined to the north, the range of two of them extending to New Guinea. Of these the Black Butcher-bird (*C. quoyi*), found in northern Queensland and the Northern Territory, is of interest because, while the adult birds are entirely black, the young are either black or reddish-brown. How long the brown plumage is worn before the black is attained is not known, but brown birds are frequently found breeding.

W.B.A.

Butter. See Dairying.

Buttercup. This name (as well as that of 'crowfoot') is popularly given to several species of *Ranunculus,* a genus abundant in temperate and cold regions both north and south of the Equator. It belongs to the family Ranunculaceae, consisting of annual or perennial herbs. Nine species are indigenous to Australia. They have white or yellow petals (the calyx falls early), each with a nectary at its base. *R. Millani* and *R. anemoneus* are white-flowered species, conspicuous on swampy ground or lake shores in the Australian Alps *R. Gunnianus,* with yellow flowers, is also an alpine species in Victoria and New South Wales, and extends to Tasmania. *R. aquatilis,* a species with floating stems and white flowers, is found in streams and pools in the coastal districts, from New South Wales to South Australia.

Butter-fish, a popular name for several species that are as widely different in appear-

ance as they are in affinities. In New South Wales and Queensland the name is applied to two allied fishes, the Striped Butter-fish (*Scatophagus multifasciatus*) and the Spotted Butter-fish (*S. argus*). The former is a deep, compressed fish with minute scales, silver in colour, with irregular vertical bars and spots of dark green; these vary so greatly that their different patterns have been considered to be characteristic of distinct species. The spotted butter-fish is golden brown, covered with rounded chestnut-brown spots. Both species are plentiful in warmer waters, and the latter ranges northward to China and India. Notwithstanding their vernacular name, they are rather despised as food-fishes.

The butter-fish of South Australia is one of the most important market fishes of that State, being identical with *Sciaena antarctica*, the Jewfish (q.v.) of New South Wales fishermen. In Western Australia the name is applied to the common *Pentapus vitta*, which though small is fleshy, and related to the breams. In New Zealand the name is given to one of the Parrot-fishes (*Coridodax pullus*), an important species in the markets, growing to 20 inches in length. In other parts of the world the name is equally popular; it is indiscriminately bestowed upon fishes both large and small, useful or valueless for the table—and they seem to merit the appellation no more than do the Australian representatives.

A.R.McC.

Butterflies, vernacular name of a group of the order Lepidoptera (q.v.) and sub-order Heteroneura, insects with scales (modified hairs) on their wings and more or less swollen terminations to their antennae; hence the group is usually known as Rhopalocera (club-horned). Some moths, including a few Australian species, also have clubbed antennae; but all these have a frenulum, and can thus be distinguished from all Australian butterflies except *Euschemon rafflesia*, which is discussed below. The popular belief that butterflies fly only during the day and moths only at night is inaccurate, since some butterflies appear only at dusk and many moths fly by day. With a few exceptions—all mentioned below—Australian butterflies, when at rest, fold their wings erect above the back.

Australia possesses 332 species of butterflies, classed in 112 genera and six families, whose characteristics are:—

A. Antennae wide apart at base: hind tibiae usually with medial as well as terminal pair of spurs: fore-wing and all veins from base or from cell, none stalked with vein R_5 beyond cell . . . . . Hesperiidae.

B. Antennae close together at base: hind tibiae with terminal pair of spurs only: fore-wing with one or more veins stalked with vein R_5 beyond cell:

a. Precostal spur of hind-wing absent. . Lycaenidae.

b. Precostal spur of hind-wing present:

(1) Front pair of legs perfect in both sexes:

i. Precostal cell of hind-wing present: vein 3A of hind-wing absent . . Papilionidae.

ii. Precostal cell of hind-wing absent: vein 3A of hind-wing present . . Pieridae.

(2) Front pair of legs imperfect in male only. . . . . Nemeobidae.

(3) Front pair of legs imperfect in both sexes. . . . Nymphalidae.

The Hesperiidae (skippers), so called from their jerky manner of flight, comprise more than one-fourth of the butterflies of Australia. On account of their small size and usually dull colour they do not often come under notice, while some are of great rarity. The larvae are smooth, with a prominent head, and live during the day-time in a curled-up leaf. The pupae are smooth, often with prominent head projections, and are found in leaves that are either curled-up or drawn together by silken threads. Of the 92 species the most remarkable is the large Regent Skipper (*Euschemon rafflesia*), found along the east coast as far south as Port Macquarie. The male butterfly (which is black, with semihyaline golden spots and greenish markings beneath) has a strong frenulum in the male; the female (similarly coloured) couples its wings in the usual butterfly manner, and has no trace of a frenulum. This species forms a connecting link between butterflies and moths. A few archaic Australian skippers rest with wings flat instead of raised. These are all most interesting species, generally of larger size than the rest of the family, in life possessing brilliant fiery eyes. A small group of robust insects (Ismeninae) is represented by six species, including *Hasora haslia* and *Parata hurama*, the latter with a broad white band on the hind-wing beneath. Another group (Erynninae, of Oriental origin) includes 26 Australian species, found chiefly in the north, where their larvae are destructive to palms and similar plants: these are usually of some shade of brown, with yellow or orange markings, and include the tiny *Padraona flavovittata* and the much larger *Cephrenes trichopepla*, whose larvae feed respectively on couch-grass and on palms.

More than half the recorded species belong to endemic genera; some are found in Tasmania, and most in southern and south-eastern Australia, but a few extend as far north as Cairns. The beautiful *Anisynta argenteo-ornata*, with its silvery splashed underside, from the islands of Western Australia; the rare *Mesodina croïtes*, from the desert near Geraldton (only four specimens are yet known); the handsome *Hesperilla picta*; the dingy *Toxidia peroni*, and the large *Trapezites symmomus* (plate xi, fig. 33)—all belong to this group. Numerous species of *Trapezites* and *Hesperilla* occur in the mountains of Tasmania and south-eastern Australia.

The Papilionidae (swallow-tails) of Australia, though not so brilliant or numerous as in the tropics, are yet sufficiently so to attract notice in the semitropical parts of the continent. The handsome black-and-green *Troïdes priamus* of the Moluccas is represented here by four distinct sub-species; *T. richmondius*, accompanied by its larger sombre black-and-white female, is frequently seen in the scrub areas of New South Wales and southern Queensland, and the larger *T. euphorion* is well known at Cairns, Kuranda and Cooktown, where it is attracted by the flowers of the scarlet hibiscus. The brown-and-cream *Papilio sthenelus* is more abundant inland than on the coast, but stray specimens are to be found throughout Australia. A small black-and-white citrus *Papilio* (*P. anactus*), endemic in Australia, is common in the orchard districts of New South Wales, and is now extending its range into Victoria and northern Queensland. The larger citrus *Papilio* (*P. aegeus*) has a much more extended range throughout eastern Australia, and is plentiful in Queensland, where a very occasional white form of the female has been taken. Through-

out New Guinea and the Solomon Islands many varying forms of this handsome butterfly occur. *P. egipius*—intermediate in size between *P. aegeus* and *P. anactus*, and somewhat resembling the former—is only found in northern Queensland, where it usually flies among tall trees. Among tailed species of *Papilio* the Australian form (*P. joësa*) of the Moluccan *P. ulysses*, with its brilliant black-bordered blue wings, makes a glorious sight as it flies above the densely wooded creeks of northern Queensland. Two similarly-shaped brown-and-white swallow-tails, *P. capaneus* of Queensland and *P. canopus* of the Northern Territory, are most interesting species. Our only two representatives of the long narrow-tailed swallow-tails are *P. parmatus* and *P. leosthenes* of northern Queensland (the latter also found on the northern rivers of New South Wales), both of which sometimes gather in numbers on a damp spot on a road or creek-bed. *Papilio macleayanus* (plate xi, fig. 32) is the only swallow-tail found in Tasmania, whence its range extends along the coast as far as Cape York. It has a swift flight when disturbed, and often soars round the tops of tall eucalypts, where its green markings can be seen distinctly in the sunshine. Of the remaining Australian swallow-tails the black-and-blue *P. choredon* is a frequent visitor wherever the camphor laurel is grown as an ornamental tree: its allied spotted species, *P. lycaon*, *P. macfarlanei* and *P. ligatus*, belong to the more tropical parts of Australia. The red-bodied *Menelaïdes queenslandicus* (the Australian form of *M. polydorus*) is found in northern Queensland, but the somewhat similar *Eurycus cressida* is taken as far south as Sydney, and is abundant in the Northern Territory: the female of *E. cressida* is almost transparent, and on the wing looks like a worn and wasted male.

With four exceptions the Papilionidae of Australia have reached the continent from New Guinea by way of Cape York, and are gradually extending south along the east coast; this progress is helped by the use of their food-plants as ornamental or economic trees. Some species have not yet come farther south than the scrub districts of Cairns; others come to the northern rivers of New South Wales, and a few extend south of Sydney. All have a more or less extended range in the Indo-Malayan region, and forms of some of them occur in India and southern Japan. Of the four exceptions to the invasion from New Guinea, *P. macleayanus* has been long in Australia, and has an interesting representative, *P. weiskei*, in the mountains of New Guinea: *P. anactus* stands by itself, there being nothing like it outside Australia: *P. leosthenes*, though so similar to the long narrow-tailed swallow-tails of the East, is really a connecting link between 'fluted' and 'kite' swallow-tails: *P. sthenelus* differs from all others of the family in frequenting the drier interior instead of the coastal regions, and probably reached Australia from Timor.

The Pieridae (whites and yellows) are not so conspicuous a feature of the landscape as in some countries, though occasional flights of some two or three species have been recorded. The beautiful *Delias*, with their showy red-and-yellow markings beneath, are much more conspicuous in the cabinet than when soaring leisurely round the tops of a flowering tree; but, when a number of them gather round a flowering *Duranta* shrub in Queensland, they attract immediate attention. *Delias harpalyce*, the largest species, is confined to south-eastern Australia; it has bright yellow splashes on the fore-wing beneath, and a band of broad scarlet spots on the hind-wing beneath. As usual in this family, the upper surface of the female is much darker than that of the male. Dainty little white *Elodina* species are often very plentiful in the north, flitting about the trees, and occasionally immense flights of *Anaphaeis teutonia* may be seen travelling in the one direction; such flights continue even over the sea at some distance from land, and large numbers may be washed ashore on the beaches. *Appias ega* and *Huphina scyllara* are widespread northern species (sometimes extending southwards), and three other species of *Appias* occur sparingly in the north. The large yellow *Catopsilia* are plentiful in northern Queensland and the Northern Territory, but are only occasional visitors as far south as Sydney, where the white species are much oftener seen—sometimes in migratory flights. The bright little sulphur-yellow genus *Terias* is represented in Australia by eight species, only one of which, *T. smilax*, reaches the extreme south. The largest is *T. sulphurata*, a form of the wide-ranging *T. hecabe*: *T. lineata*—and sometimes *T. herla*—have the hind-wing beneath suffused a delicate pink.

The Lycaenidae (blues, copper and hairstreaks) comprise slightly more than one-third of Australian butterflies. Generally of small size, they are unrivalled for their dainty appearance, and are often gems of great beauty. They are the only group that is found throughout Australia wherever vegetation exists. Some species occur on the seashore; one is the only butterfly seen in any number near the cairn on Mount Kosciusko; the larvae and pupae of others are found associated with ants. These larvae, through certain dorsal glands, secrete a fluid that is much sought after by ants (especially those belonging to the genera *Camponotus* and *Iridomyrmex*); the ants, therefore, house the larvae in order to gather the secretion and, in return, look after both larvae and pupae and protect them from enemies. During the day the larvae are found hiding in ants' nests or tunnels, or under pieces of bark, or in holes and cracks in trees. The writer ventures the opinion that in some cases the ants collect the eggs and take them to their nests, besides guiding the larvae to and from their food after they have emerged. In some few cases it is suggested that the ants feed the larvae.

Though much time has been spent in the study of this family, its divisions cannot yet be said to be wholly satisfactory. The largest species is the robust *Liphyra brassolis*, which seems quite out of place amongst its dainty relations. This orange-and-brown species is found in the north; its larvae live in the nests of the green tree-ant, and probably feed on the ants' larvae and pupae, being themselves protected by a chitinous armour-plate which their hosts cannot penetrate. The group of hair-streaks is not well represented in Australia, though some remarkable forms are found in the north—e.g. the long-tailed *Bindahara isabella*, and species of *Deudorix*, *Rapala* and *Hypolycaena*. The genus *Ialmenus*, which occurs almost throughout Australia, is the best-known. In Victoria, New South Wales and southern Queensland the well-known *I. evagoras* is to be found, sometimes in numbers, flying round acacias, on the leaves of which its larvae feed. *Pseudalmenus chlorinda*, var. *zephyrus* (plate xi, fig. 31), a related species, is found in Victoria,

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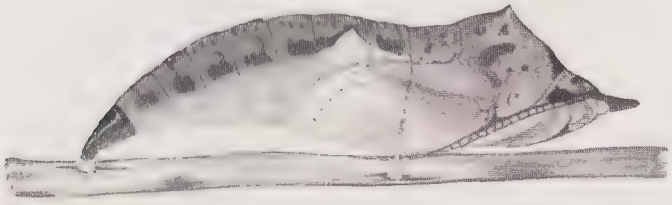


3

4

Life History of *Anaphaeis java*, var. *teutonia*.

1. Egg, 30 times natural size. 2. Larva, four times natural size. 3. Pupa, four times natural size. 4. Butterfly, thrice natural size.

with closely allied forms in Tasmania and New South Wales. The genus *Arhopala* contains several handsome insects, found only in tropical Australia. One genus of importance, *Ogyris*, is found both in the tropics and in more temperate latitudes; with the exception of one New Guinea species all the described forms are from Australia. For brilliancy of blues and purples, and occasionally of green, these butterflies are unrivalled; they are not so rare as is generally supposed, but only the expert succeeds in obtaining them, since when seen on the wing they are usually far out of reach. The genus *Thysonotis* contains some very handsome species, of which one extends its range nearly to Sydney, though both species and individuals are more plentiful in the tropics. The genus *Miletus*, found throughout continental Australia, contains species of extremely brilliant colouring, especially on the under-side. Notable examples are *M. halyaetus* from Geraldton in Western Australia, with its silvery green under-side, and the copper-coloured *M. apollo* and *M. apelles*. Most Lycaenidae, however, are small and of a sombre blue. The little *Zizina labradus* occurs nearly everywhere in Australia, the larva's food-plant being clover, lucerne and allied plants; occasionally it may be found feeding on French beans. The somewhat similar, but larger and tailed, *Lampides boeticus* feeds at times on sweet peas. These are probably the only two butterflies that occasion any damage—and that only slight—to our garden plants.

The Nemeobidae are represented by two genera only, each containing a single species; both are found in northern Queensland.

The great family Nymphalidae has Australian representatives of six sub-families. The pupae of this family suspend themselves by the tail, and hang head downwards. *Acraea andromacha*, the only Australian representative of a group that has numerous species in Africa, has almost transparent fore-wings, and is marked with black spots. The sub-family Nymphalinae contains strong-flying robust species, usually with wide ranges through the east, and rarely with more than one species to the genus in Australia. *Argynnis inconstans*, still a rarity in collections, represents the fritillaries of Europe. In northern Queensland *Cupha prosope*, *Cethosia chrysippe* and various species of *Neptis* are not uncommon; the Australian Leafwing (*Doleschallia australis*) reaches northern New South Wales, and *Hypolimnas nerina* is sometimes found in Sydney, where the handsome *Eulepis sempronius* is seen every year. The only species that extend farther south are *Pyrameis kershawi*, which feeds on everlasting-daisies, and *P. itea*, which feeds on nettles; the former is closely allied to the 'painted lady' of Europe, and the latter is the Australian 'admiral.' The truly Pacific butterfly *Precis villida* is also an inhabitant of southern Australia. The sub-family Amathusiinae is represented by two species of *Taenaris*, with very large eye-spots on the hind-wings; these have only been caught on the islands in Torres Straits. A single species of the Elymniinae has been caught at Cape York.

The sub-family Satyrinae (browns) prefers the shade of gully and forest, and forms an important element in the Australian fauna; with the exception of *Melanitis* and *Mycalesis* in the north, and the smaller *Hypocysta* and *Yphthima* which extend farther into New South Wales, its species belong to endemic genera that are confined chiefly to the southern and south-eastern portions of the continent and to Tasmania. The genus *Tisiphone* contains an interesting assemblage of forms that may throw some light on the earlier physiographical changes of the east coast. *Xenica* and *Heteronympha*, with their allied genera, are generally of some shade of orange or brown; some have a wide range, others are not found below an elevation of 4000 feet. These genera have not yet been fully studied, but enough has been done to show that in some cases they have developed distinct local variations. *Heteronympha merope* (female shown on plate xi, fig. 30) from the east can readily be distinguished from the form found in the west, and the Tasmanian form presents special points of difference. The pretty little species of *Oreixenica* are common at high elevations in the Australian Alps; one species (*O. lathoniella*) is found near sea-level in Tasmania. *Nesoxenica* is the only genus confined to Tasmania; its single species (*N. leprea*) has developed two forms, of which that found in the centre and on the west coast is much brighter than the typical form from Mount Wellington.

In the sub-family Danainae the black-and-white genus *Euploea* has about 10 species, occurring chiefly in the north, though the common *E. corinna* is sometimes found near Sydney. The same distribution is true of the allied genus *Danaida*; two tawny species are common at times near Sydney and even farther south, and two others are rare visitors to Sydney, but all are more common as we go north. Both *Danaida* and *Euploea* belong to tropical groups which have invaded Australia—not to the older Australian fauna, which is represented by most of the satyrids and a large number of the lycaenids and hesperids.

Economic Importance:—Few Australian butterflies are destructive to cultivated plants, though the larva of *Papilio aegeus* infests orange-trees in New South Wales and Queensland, and that of the smaller *P. anactus* seems likely to become a serious pest in the orange groves of Mildura and Renmark on the Murray. Occasionally the caper and allied plants are defoliated by the larva of the White Caper butterfly (*Anaphaeis teutonia*), which appears periodically in immense swarms throughout eastern Australia, and is sometimes blown across the straits to Tasmania; there, however, it does not breed. A small lycaenid (*Zizina labradus*) attacks beans—and sometimes lucerne, peas, and other legumes—in the southern districts of Australia.

See *Australian Butterflies*, by A. S. Olliff (1889); *Victorian Butterflies*, by Anderson and Spry (1893); *A Guide to the Study of Australian Butterflies*, by W. J. Rainbow (1908); and *The Butterflies of Australia*, by Waterhouse and Lyell (1914), in which all known Australian butterflies are described and figured. G.A.W.

Butterfly Ray. See STING-RAYS.

Buvelot, ABRAM LOUIS. See ART.

Buzzard. SEE HAWKS.

C

Caddis-flies, insects of the well-defined order Trichoptera, the closest relatives of which are undoubtedly the Lepidoptera on the one side and the Mecoptera and Diptera on the other. Fewer than 30 Australian species have been described, but more than 100 are known to exist in various collections. They are for the most part not unlike small moths; but only occasionally are the wings clothed with scales, their usual covering being abundant hairs, as the name of the order indicates. They are also recognizable by the specialization of their mouth-parts, which are so far reduced as to be of no use to the imago, except for the occasional lapping-up of dew or water; the only well-defined parts are the labrum and the two pairs of palpi. The wing-venation is on the same plan as that of the Mecoptera; but the first cubitus is forked, and cross-veins are restricted to a few places, where they are of special advantage for the bracing of main veins. The wing-venation also closely resembles that of the homoneurous Lepidoptera, from which it differs in having M_4 present as a separate vein in the fore-wing, but always absent in the hind-wing. The larvae (known as caddis-worms) resemble caterpillars, but lack all the pro-legs except the anal pair; they are familiar objects in all ponds and streams, dwelling for the most part in small portable houses or cases, which they construct out of sticks, leaves or sand-grains. Some, however, build fixed dwellings of pebbles, and some roam free on the river-bed. The pupa is a *pupa libera,* formed inside the larval case; it swims to the surface before disclosing the imago.

There are two well-marked sub-orders. In the sub-order Aequipalpia the maxillary palpi are five-jointed in both sexes. All the families are represented in Australia, except only the Molannidae; but few of the species in collections have been named and described. On the whole, they show a close similarity with the New Zealand forms, which are better known. Genera common to both countries are *Hydrobiosis* (Rhyacophilidae), *Polyplectropus* (Polycentropidae), *Hydropsychodes* (Hydropsychidae), and several common genera of Leptoceridae. Some of the loveliest of our caddis-flies are the sub-alpine species of the genus *Smicridea,* whose snow-white males fly together in thousands, resembling a miniature snow-storm. The commonest caddis-flies in Australia are the long-horns, members of the family Leptoceridae; of these, the dull-coloured *Notanatolica magna* is the largest and best-known. Numbers of males may be seen flying gracefully near still water in the springtime. Smaller species of similar habits, with very elongated and slender fore-wings, belong to the genera *Triplectides* and *Oecetis.* Plate xix figures two rare and handsome caddis-flies, *Stenopsychodes montana* (fig. 21) from the Blue Mountains, and *Macronema pulchripenne* (fig. 22) from Stanwell Park in New South Wales.

Notanatolica magna.

In the sub-order Inaequipalpia the maxillary palpi are five-jointed in the female, but only three- or four-jointed in the male. The sub-order contains three families. Few species have been described—all anomalous forms that are placed among the Sericostomatidae, but have little in common with more normal members of that family. Among them are the extraordinary *Plectrotarsus gravenhorsti* with its elongated beak, and the remarkable Marine Caddis-fly (*Philanisus plebejus*) whose larva forms cases out of coralline seaweed, and is found in many places along the coasts of Australia and New Zealand. Species of *Helicopsyche* make sand-cases in the form of a spiral shell; they are common objects attached to rocks in running streams. There are also some remarkable species with whorls of spurs on the tibiae, but these have not yet been named.

The families Phryganeidae and Limnephilidae, dominant in the northern hemisphere, appear to be absent from Australia.

See Ulmer in *Genera Insectorum,* fasc. 60, and *Arkiv. Zool.* x, 13.

R.J.T.

Cadell, Francis (1822-1879), born at Cockenzie near Prestonpans in Scotland, and educated in Edinburgh and Germany, in 1835 entered the service of the East India Company as a midshipman, and in 1840-1 took part in the first Chinese war. At 22 he was in command of a vessel, and between voyages devoted much study to shipbuilding and marine steam-engines. A visit to South Australia in 1848 interested him in the problem of navigating the Murray, Sir Henry Young (q.v.) having about that time offered a bonus of £4000 for the first two shallow-draught steamers of not less than 40-horse power that should be taken up-river from Goolwa to the junction of the Darling. This induced Cadell to return to Australia in 1850, and in 1852, accompanied by four gold-diggers, he navigated a canvas boat from Swan Hill to Wellington, voyaging thence in a stronger boat to Lake Alexandrina—1300 miles in all. Arriving in Adelaide, he joined William Younghusband in forming the Murray Steam Navigation Company; its first river steamer, the *Lady Augusta* (which was built in Sydney and engined by P. N. Russell & Co.), he himself took—along with a 100-ton lighter—from the Murray mouth to Swan Hill in a little more than three weeks (August 25 to September 17, 1853), having Governor Young aboard, and brought back the

first cargo of wool (441 bales) ever transported from the Riverina to Adelaide. For this achievement he was presented with a gold candelabrum worth 900 guineas, and the local legislature had a gold medal struck in his honour. He now commenced regular trading trips along the Murray, added the *Albury* and the *Gundagai* to the company's fleet, and sought on every trip to reach towns farther from the river-mouth. In October 1855 he thus reached Albury (1740 miles from Goolwa), and in 1858 Gundagai on the Murrumbidgee (2000 miles from Goolwa). In 1859 he ascended the Darling to Mount Murchison near Menindee. Valuable as this work was for Australia, it was quite unprofitable for Cadell; his company was never a success, and its collapse ruined him. During the Maori war of 1860-5 he was employed in the transport service; then he settled for a time at Mount Murchison; then, embarking on pearl-fishery along the northern coasts of Australia, he explored the Gulf of Carpentaria and in November 1867 discovered the mouth of the Roper River. Ill-luck still pursuing him, he began to trade with the Dutch islands of the Arafura Sea; and, while voyaging from Amboina to the Kei group, was murdered by his native crew in June 1879.

Caesalpinia, a genus of the family Leguminosae, consisting of shrubs, trees, or climbers, chiefly tropical. The flowers are yellow; pod oval and compressed; leaves with numerous leaflets. The seeds of *C. bonducella,* a prickly climber, are known as 'nicker nuts' or 'Molucca beans;' in India as 'fever nuts' or 'physic nuts.' They are very bitter and largely used in India as a tonic or febrifuge. In Amboina the roots are used for dyspepsia and the seeds as an anthelmintic. The roots of *C. nuga* also possess medicinal properties.

Cairns, Sir William Wellington (1828-1888), son of William Cairns of Cultra in county Down, Ireland, and half-brother of Disraeli's lord chancellor Earl Cairns, was born in 1828, and trained for the civil service. After some eastern travel he entered the Ceylon civil service in 1852, was made the colony's postmaster-general in 1864, and returned to England in 1866 to commence a round of colonial governorships—becoming lieutenant-governor of Malacca in 1867, of St. Kitts in 1868, of Honduras in 1870, and governor of Trinidad in 1874 and of Queensland in 1875. In 1877 he was transferred to South Australia, but his commission as governor did not reach the colony until after he had left it, so that he ranks officially as administrator. His transference to Australia had been necessitated by ill-health due to the West Indian climate, but Queensland did not cure him, and his tenure of the South Australian post lasted less than two months (24 March to 17 May). He then retired from the colonial service, and died in England on 7 July 1888. (C.M.G., 1874; K.C.M.G., 1877.)

Caley, George (1775-1829), was born at Craven in Yorkshire; but his father, a horse-dealer, moved to Middleton near Manchester while Caley was still a small boy, and for a short time he attended the Manchester Free Grammar School. Following his father's trade, he found that farriery included some knowledge of plants, and took up the study of botany with ardour. An application to Sir Joseph Banks resulted in an appointment in 1794 to Kew Gardens; the drudgery tried Caley's restless disposition, and he went back to Lancashire, but returned to Kew in 1798. Later in that year Banks made him his own botanical collector in New South Wales, procured him a free passage in the transport *Speedy,* and introduced him to Philip Gidley King, who was travelling in the same vessel to succeed Hunter as governor. Leaving England on 12 November 1799, Caley reached Sydney on 15 April 1800, and soon found a home at Parramatta; there a botanical garden was marked out, which, with Colonel Paterson as director and Caley as superintendent, made such good progress that in 1802 François Péron, a French naturalist then visiting Sydney, was delighted with the collection of rare and beautiful plants, and spoke of Caley as enlightened, indefatigable, and modest. Caley's house and rations were supplied by the government, but his salary was paid by Banks, and he kept to himself as much as possible the discoveries he made and specimens he collected, considering himself Banks's employee. This secrecy annoyed King, and he complained again and again to Banks about it. The friction was increased by Caley's character; Banks described him before his departure for Australia as 'young, full of health, and abounding with zeal'—a zeal that probably accounts for the impatient demands on King which made that harassed governor mournfully deprecate 'Caley's abuse.' The botanist, on the other hand, complained to Banks of King's dilatoriness and Marsden's 'affronts,' and was soothingly warned that 'Some ill-treatment we all must endure. I hope your share of it is not greater than mine has been at your time of life.' Caley's love affairs were also worrying to high officials; he was very anxious to marry a convict woman who had come out in the *Speedy,* and afterwards transferred his affections to Margaret Catchpole (q.v.).

In March 1801 King sent Caley with Grant and Barrallier (q.v.) in the *Lady Nelson* to Western Port on Bass Strait; several collections of plants were made, but Caley managed to acquire them all, and would not give them up. Still, King admits that he 'behaved extremely well, and is much regarded by Lieutenant Grant.' One voyage, however, satisfied his love of the sea, and thenceforth (except for a trip to Tasmania in 1805) he confined himself to exploration by land. In 1802 he made several excursions to the foot of the Blue Mountains, and once at least saw from Mount Hunter behind Camden a landscape of wooded hills and rocky valleys that made him believe the ranges were not impassable, though probably difficult in wet weather. King, who was at the time sending Barrallier into the range behind Picton, could get nothing out of him: 'what he has done remains secret.' But in November 1804 'four of the strongest men in the colony, who had been accustomed to live in the woods' were allowed to accompany Caley on a journey intended to pierce the range west of Windsor. He made west from Grose junction on the Hawkesbury, crossed the Kurrajong ridge and Mount Tomah, and in 12 days had reached Mount King George (which he named 'Mount Banks'); there he came out on an inaccessible valley—the Grose opposite Govett's Leap—and his party refused to go farther. If he had turned northwards and rounded the head of the valley, he would have crossed the range with little difficulty. His track (which is made certain by his own tracings and outlines of views obtained

en route) coincides very nearly with the eastern section of 'Bell's Line,' so named from the surveyor who afterwards laid it out as an alternative route from Hartley to the coast.

For the time, however, even he was convinced that the hills were impassable, and contented himself with botanizing in the Nepean valley. In November 1805 he paid a short visit to Hobart (via Norfolk Island) and collected plants, a wombat and a porcupine. In 1806 he was again exploring the Picton country, and formed plans—which he could never carry out, because neither King nor Bligh gave him sufficient help—to explore (*a*) the Nepean gorges between Penrith and Camden, (*b*) the rough country south of Mittagong towards Jervis Bay. In August 1808 Banks, on the ground of his own failing health and eyesight, terminated Caley's employment but offered him a pension of £50 a year, with leave to stay in Australia or return to England at his choice. Caley preferred to return, and left Sydney in H.M.S. *Dromedary* on 12 May 1810, taking with him (much to Banks's subsequent embarrassment) an aboriginal named Dan. In England he settled for a time at Manchester, but in 1816 was made superintendent of the botanical gardens at St. Vincent in the West Indies; returning to England in 1823, he settled in Bayswater, and died there on 23 May 1829.

His temperament has already been described; no better evidence of it is needed than his long letter to Banks describing the Bligh mutiny, and commenting caustically on both parties. As a botanist, though his results were never published and we know practically nothing about them, he was much respected by his contemporaries; Cunningham calls him 'accurate, intelligent and diligent,' and Brown 'most assiduous and accurate.' He collected plants for Banks, but considered his other specimens his own, so that in 1818 he sold to the Linnean Society a large collection of quadrupeds, birds and reptiles, and after his death his collection of Australian timbers was presented to the same society by his executors. A genus of Australian orchids and many species of plants bear his name, as well as a hill in the Peel Range, New South Wales. The name 'Caley's Repulse,' given to a cairn near Linden on the Blue Mountains by Macquarie, is certainly a misnomer; Caley was never on that ridge.

Callicarpa, a widespread genus of the family Verbenaceae, consisting of shrubs, more or less woolly with star-shaped hairs, and often marked with resinous dots. In the flowers the calyx is truncate; corolla with a short tube; stamens 4-5, shortly protruding; fruit a small succulent drupe of 4 distinct 1-seeded nuts. *C. longifolia* is the 'chukin' of the aborigines near Cairns in Queensland. The bark is chewed by Japanese on the Johnstone River as a substitute for the betel leaf. *C. pedunculata* is an ornamental shrub, cultivated in gardens.

Callicoma, a genus of the family Cunoniaceae, two species of which are endemic in Australia and one in New Caledonia. The sepals are 4-5, free; petals obsolete; fruit a small capsule separating into distinct carpels opening along the inner edge; seeds more or less covered with tubercles. *C. serratifolia*, a tall shrub or small tree, has large leaves with saw-like teeth and dense globular heads of flowers resembling those of many Acacias. The early colonists called it 'black wattle,' from its dark bark, and its use for the frame-work of their wattle-and-dab huts. The name (which persists in Blackwattle Swamp, Sydney) is now exclusively associated with the genus *Acacia*. The 'saw-leaved' *Callicoma* has a close-grained timber, of a pinkish colour when fresh, which works to a nice smooth surface. It is occasionally used for small articles in wheelwrights' work, but rarely attains a large size. The saplings split easily, and have been used for basket-making.

Callicoma serratifolia.

Callistemon, a genus of the family Myrtaceae, endemic in Australia, consisting of shrubs or small trees (commonly known as bottle-brushes) with flat or cylindrical leaves and showy greenish-white, pale yellow, or crimson flowers, in dense cylindrical spikes. The flowers are borne on the tips of the branches; but the shoot continues its growth, and in the following season a new flower-spike is formed at its apex, a foot or more higher up the branch. The calyx-tube is bell-shaped, with 5 deciduous lobes; petals 5, orbicular; stamens numerous, free or shortly united at the base in a ring; fruit a capsule opening at the top, closely appressed to the branch. The fruits are persistent, and their age may be computed by counting the clusters, commencing at the base of the stem. As the seeds do not reach maturity for several years, this character is of service to the collector in securing ripe seeds. The name 'bottle-brush' is also occasionally applied to the Banksias (q.v.).

C. lanceolatus, the common Red Bottle-brush ('marum' of the aborigines) is found in Victoria, Queensland, and New South Wales, and is plentiful in swamps in the Port Jackson

district. Under cultivation it displays great variation in habit, height, foliage, and shade of red. *C. salignus* (White Bottle-brush, 'unoyio' of the aborigines) has a hard, close-grained timber with a reputation for durability underground. *C. viminalis* (Drooping Bottle-brush), a tree reaching 60 feet in height, has a tough timber extensively used for knees and braces of boats.

White Bottle-brush.

Callitris, a genus of the family Pinaceae, consisting of coniferous trees, commonly known as Cypress pines, and many with distinctive popular names. Indigenous to Australia, it ranges from Tasmania to the tropics, and from the coast to the interior. Most species exude a sandarac resin with a powerful aromatic odour; the bark of several is used for tanning. It is to a *Callitris* (probably *C. robusta*) that Paterson refers in 'The Man from Snowy River:'

> 'And down by Kosciusko, where the pine-clad ridges raise
> Their torn and rugged battlements on high.'

C. calcarata is the Black or Red Pine of New South Wales, Victoria, and Queensland. Twigs of this tree have been used as a vermifuge for horses. *C. robusta* (White or Common Pine) occurs in all the States. Its timber is resistant to white ants, and for this reason was largely used in the construction of railway stations on the transcontinental railway; being also, to a great extent, impervious to attack by the teredo, it is used for wharf-piles and other marine purposes. *C. rhomboidea* is the well-known Oyster Bay Pine of eastern Tasmania, but occurs also on the mainland, extending from South Australia to Queensland; its timber is in much demand for telegraph posts. *C. cupressiformis* is the Middle Harbour Pine of Sydney. *C. Muelleri* is the Blue Mountain Cypress.

White Pine.

Calotis, a genus of the family Compositae, consisting of perennial herbs (rarely annuals) endemic in Australia. The involucre is hemispherical; bracts with dry or scarious margins; achenes or ray florets with a pappus of two or more barbed bristles; flowers white, blue, or yellow. *C. cuneifolia* (with blue flowers) and *C. lappulacea* (with yellow flowers) are known in the west as bindieyes (or bindeïs—the spelling is doubtful). Their burr-like flower-heads become entangled by the barbed bristles in the wool of sheep, and thus depreciate the value of the fleece.

Camels. According to N. E. Philipson of Beltana, formerly manager of Sir Thomas Elder's northern stations, the camel was first introduced into Australia in 1840, when the survivor of three animals purchased at Teneriffe was landed at Port Adelaide. The second importation was made in 1860, when Sir H. Barkly, governor of Victoria, was authorized to buy camels from India for the Burke and Wills expedition, and '24 camels from Peshawur, of both the fleet and heavy species, were landed in first-class order.' In 1866 Elder imported 100 camels, of which a large proportion died from a virulent form of mange; the rest were acclimatized on his Beltana station and bred freely—'they thrive' said Philipson, 'on the natural shrubs, especially saltbush and various acacias, and never eat grass unless driven by extreme hunger.' These camels were employed in carrying supplies along the overland telegraph line during

its construction in 1871-3. Camels have been regularly employed for exploration, and have proved eminently suited for carrying heavy goods in the drier regions of the interior. In the Elder scientific expedition (1891-2) David Lindsay's riding camel carried him for 20 days on 6 gallons of water, and extracts from his diary will give details of a camel's endurance: —'1st. August. All except my riding camel had a drink. 24th. Aug. They had their next drink. 30th. Aug. All had their full drink (42 camels—some carrying 700 lb.). 1st. Sep. At 20 miles each had 2½ gallons. 4th. Sep. A few had 2½ gallons. 7th. Sep. The rest had 2½ gallons of dirty water. 25th. Sep. At 400 miles each had 2½ gallons.'

Camels are now in general use in the interior of Western and South Australia, New South Wales, and Queensland, especially in the first two States. They are employed by the survey and the water conservation departments, also as mail-carriers, and for the transport of supplies to mines and telegraph stations. Riding camels are used by the police and by station managers for urgent work, and will cover 100 miles a day for a week. An offender on horseback has no chance against a constable on a dromedary.

Among owners and breeders are still many Afghans, but since the war the industry has begun to pass into the hands of Australians who handled camels in Egypt and Palestine. The South Australian government breeds about 50 a year at Mount Searle On long journeys Arabian camels are loaded with 3 cwt. at most, but much heavier burdens are put on the more strongly-built Egyptian camels. The Australian-bred camel carries an average load of 550 to 600 lb., and will travel 25 miles a day for two months at a stretch.

The latest returns (1922-3) give 11,079 as the number of camels in Australia, but it is believed that there are some hundreds in a wild state in the interior.

Campbell, ROBERT (1769-1846), born at Greenock in Scotland on 28 April 1769, was in 1796 in the employ of his elder brother, the head of Campbell, Clark and Co., merchants in Calcutta. Late in that year the firm sent the *Sydney Cove* with a cargo of merchandise to test the Sydney market; but the vessel encountered heavy gales for nearly two months, leaked seriously, and on 8 February 1797 was beached on Preservation Island in Bass Strait to save her from sinking. (The subsequent adventures of her crew are referred to under EXPLORATION BY SEA.) When the news reached Calcutta, the firm sent off Robert Campbell in the snow *Hunter* to obtain information both about the wreck and about the Sydney market; and his report on the market was so favourable that he was sent back in June 1798 to represent the firm at Sydney. He thus became the first free and non-military merchant to settle in New South Wales. Leasing a strip of land along the western side of Sydney Cove, he constructed what was for many years afterwards well known as 'Campbell's Wharf;' but the grasping policy of the trader-officers of the New South Wales Corps at first prevented him from establishing a regular business. King's arrival, however, in 1800 much improved matters: except spirits, he said (and it was an important exception, for Campbell had just imported 13,336 gallons), anything 'of use or comfort' might be freely imported—'the interest of the fair-dealing merchant, and rescuing the settlers and other inhabitants from the oppressive monopolies that have hitherto existed here, will be equally the object of my attention.' Under the new regime Campbell prospered exceedingly. His importations of cattle from India, under a contract with King, more than doubled the colony's herds between 1800 and 1803; and in the latter year King praised his 'fair and equitable proceedings as a merchant' and welcomed his assistance in destroying 'the extortions and degrading monopolies that formerly existed here.' But he could not resist the tempting trade in spirits, and in 1805 King had to ship back to India 17,500 gallons that had been irregularly imported. This did not, however, hamper his relations with King or his successors, whose official correspondence is full of references to the trade in cattle, sealskins, whale oil, rice, timber, etc., carried on by the Campbell house. Bligh in May 1807 made him treasurer, collector of taxes, and 'naval officer' (i.e. superintendent of customs); this in October brought him into collision with John Macarthur (q.v.) over the importation of distilling apparatus, and (together with his support of Bligh at the time of the mutiny) caused his dismissal from office by Johnston in April 1808, which Foveaux followed up with several bitter attacks on his character and business. Macquarie formally reinstated him, but persuaded him to resign, on the ground that a merchant should not be in a position to levy taxes on his rivals' goods. He gave evidence for Bligh at Johnston's trial in England, and on return to Sydney settled down to enlarge and consolidate his private business. His relations with Macquarie were never very friendly, but Brisbane liked him, and recommended that he should be one of the first non-official members of the legislative council of 1824; Darling appointed him to this position, which he held until the council disappeared in 1843. It is noteworthy that an address presented to Darling in January 1826, in which the appointment of councillors by the crown is criticized, the choice of Campbell to represent local commercial interests is styled good and judicious.

In 1806 King had chartered one of Campbell's vessels, the *Sydney*, to fetch provisions for the colony from Calcutta, and on her way thither she had been wrecked off the New Guinea coast. In 1821, after lengthy negotiations, Bathurst allowed Campbell as compensation for this loss £2000 in cash and another £2000 in land or cattle. In 1825 the allowance was partially satisfied by a grant of 4000 acres at 'Limestone Plains' west of Queanbeyan (see CANBERRA), and in 1829 Darling, by order of the colonial office, increased the grant to 5000 acres. This became the famous Duntroon station, resumed in recent years for the federal military college; to it Campbell retired during the thirties, and began to interest himself in squatting, acquiring about 50,000 acres near Tumberumba. He died at Duntroon on 16 April 1846. After 1810 his chief pursuit was the development of his business. He was trusted and consulted in all important civic affairs, the funds of the first savings bank were deposited with him until 1833, and he was one of the chief supporters of the proposal to establish 'King's schools' under the Church of England which is described under BROUGHTON, W. G. His eldest son Robert, also a merchant, represented the city of Sydney in the legislative

council from 1851 to 1856, and in the new assembly from 1856 to 30 March 1859, when he died. He was treasurer in the first and second Cowper ministries.

Canadian Exiles, a term often applied to a number of political prisoners who in 1839 were transported from Canada to Tasmania. In December 1837 political discontent among the newer settlers in Upper Canada (now the province of Ontario), which had long been governed by a narrow oligarchy controlling its legislative council, culminated in a rebellion intended to transfer the colony to the United States. It was ill-conceived, unpopular, and easily put down; but the British government determined that the rebel leaders must suffer exemplary punishment, and Sir George Arthur, who was at once made lieutenant-governor of the province, had orders to use the utmost rigour of the law against them. About the middle of 1838 17 of them were caught, tried, and sentenced to death; two only, however, were hanged, and the rest transported—some to Bermuda, the rest to Tasmania, which they reached in the *Marquis of Hastings* towards the end of 1839. Three died almost immediately on arrival, owing to the vile conditions that had prevailed in the convict transport; the others were assigned to station owners inland, and three of them (Wait, Gemmel, and Chandler) having in 1841 by direction of the colonial office obtained tickets of leave, used their comparative freedom to escape to New York. The story of their punishment is told in Benjamin Wait's *Letters from Van Dieman's Land* (Buffalo, 1843), coupled with much vindictive abuse of Arthur, who was acting under definite orders in a case of aggravated treason to the Crown: on the outward voyage they, like all the convicts in their company, were disgracefully treated, but in Tasmania they appear to have received fair and considerate treatment. In February 1840 88 more of these rebels reached Australia in the *Buffalo,* 30 being landed at Hobart and the rest taken on to Sydney. There is no record of their later history: they seem to have been absorbed into the mass of convicts without special notice.

Canavalia, a genus of the family Leguminosae, widely distributed and chiefly tropical, consisting of large twiners or trailers. The flowers are large, purplish-pink to white; pod usually oblong, with a prominent longitudinal rib on either side of the upper margin; leaves have 3 leaflets. The only species indigenous to Australia is *C. obtusifolia,* a prostrate, trailing, maritime species, of some value as a sand-binder. The cooked seeds are eaten by the aborigines, but are poisonous when raw.

Canberra, the capital city of the Commonwealth now (1925) under construction, lies in an area which was originally a station on the Molonglo River about 14 miles above its junction with the Murrumbidgee. The district was discovered by Charles Throsby in April 1821, and was traversed by Currie and Ovens in May 1823, during the journey in which they discovered the Monaro Plains (see EXPLORATION BY LAND). In the same year Joshua John Moore, registrar of the governor's court, established a station on the north bank of the Molonglo at a spot which he afterwards referred to sometimes as 'Canberry' and sometimes as 'Canburry.' Almost simultaneously Robert Campbell (q.v.) established his station a few miles upstream at a spot then known as Pialligo. The whole district was in those days called Limestone Plains. As was then usual, the land was first occupied, then asked for: permission to occupy would then be given, either by warrant or verbally by the governor, and the formal deed of grant issued several years later. Moore occupied his land in 1823, obtained his warrant on 3 May 1825, and his grant on 12 October 1838: Campbell occupied his in or about 1823, obtained a promise from Brisbane on 18 May 1825, and his grant on 29 October 1834. Moore's grant—which he purchased for £250—was of 1000 acres, subsequently increased by a further purchase (at the same rate) to 1742 acres: it is variously described by the surveyors as 'Canbury,' 'Canberry,' and 'Cambury.' The Polish naturalist Lhotsky, who visited the district in 1834, spells it 'Kembery,' and says that this was the name given by the local aborigines to that part of the Molonglo River, but Moore talks of 'Canburry Creek' as a tributary of the Molonglo. Sir Thomas Mitchell, then surveyor-general and all-powerful in the matter of nomenclature, approved of the name: and, as he had a strong and frequently expressed objection to the foisting of English names on Australian localities, we may regard it as certain that 'Canberra,' however it is spelt, is of aboriginal origin. The spelling just given, which is now official, is first found in official documents about 1857. The official pronunciation was definitely settled on 12 March 1913, when Lady Denman (wife of the then governor-general) in announcing the name of the future capital city stated definitely that it must be spelt with two 'r's, but pronounced with the accent on the first syllable (i.e. as though it were 'Cannbera').

The name Canbury was originally applied only to Moore's grant, but was soon extended to include the whole plain north of the Molonglo between Black Mountain and Mount Ainslie, Moore's grant thenceforward being known as Acton. In 1841-5 the Campbell family built in the middle of the plain a church which took its name; a few houses sprang up round the church, and by the end of the fifties had constituted the village of Canberra.

The story of Campbell's grant is told under his name. It was originally of 4000 acres, another 1000 acres being granted to him by Darling in 1830; this became the nucleus of Duntroon station, which is now the site of the Royal Military College of Australia.

Up to 1908 the Molonglo valley from Queanbeyan downwards was merely one among many tableland areas near the main range occupied by squatters. In the thirties and forties there was a small amount of closer settlement, free immigrants with their families taking up their residence round Queanbeyan but acting either as tenant farmers or as station employees. In the sixties a good many of these men became small freeholders, acquiring their farms as selections under the Robertson land acts; but up to 1911 the best part of the area that now constitutes the Federal Territory was comprised in nine large stations. Gungahlin (20,000 acres), Duntroon (30,000), Yarralumla (40,000), and Uriarra (20,000) lay side by side in the north; southwards were Tidbinbilla (10,000), Tuggeranong (11,000), Lanyon (10,000), Cuppacumbalong (18,000) and Booroomba (28,000), besides a large area of leased cattle-country in the Gudgenby watershed. On a small farm, Lambrigg near Cuppacumbalong, W. J. Farrer (q.v.) carried out many of his experiments in wheat-growing.

It was the debates over the site of the federal

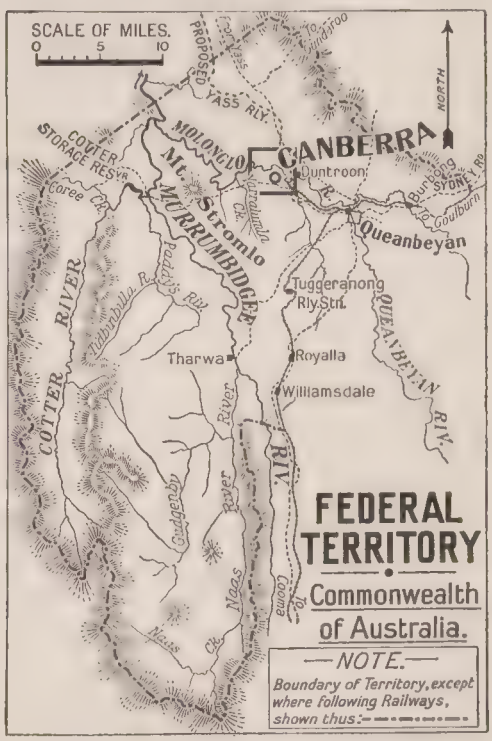
capital city, of which an account follows, that at last brought the district into prominence. Section 125 of the constitution provides that

> The seat of Government of the Commonwealth shall be determined by the Parliament, and shall be within territory which shall have been granted to or acquired by the Commonwealth, and shall be vested in and belong to the Commonwealth, and shall be in the State of New South Wales, and be distant not less than one hundred miles from Sydney.
>
> Such territory shall contain an area of not less than one hundred square miles, and such portion thereof as shall consist of Crown lands shall be granted to the Commonwealth without any payment therefor.

This clause was placed in the constitution as a result of the premiers' conference of 1899, and in November of that year the New South Wales government appointed a commission which reported that the most suitable districts were (*a*) the southern Monaro, round Bombala or Eden, (*b*) the Canobolas hills near Orange, (*c*) Yass. In January 1903 the Federal government appointed a royal commission to report on sites near Albury, Armidale, Bombala, Lake George, Orange (including the district from Bathurst to Lyndhurst), and Tumut. The report, issued in July, placed these sites in the following order, Albury, Tumut, Orange, Lyndhurst, Armidale and Bathurst (equal), Lake George, Bombala, and Dalgety (equal); but a supplementary report dated 4 August gave special consideration to the site of Dalgety.

In October, a ballot having been taken to ascertain the opinions of members, Tumut was selected, and a bill to confirm this choice was passed by the house of representatives; the senate, however, substituted Bombala. The federal government then obtained from the government of New South Wales the services of two surveyors to investigate the rival districts, and after considering their report passed on 15 August 1904 a seat of government act establishing the capital site within 17 miles of Dalgety on the Snowy River, NW. of Bombala, and providing that the territory should contain an area of not less than 900 square miles, and should have access to the sea. This decision aroused violent opposition in the New South Wales legislature, as the locality was considered too far from Sydney, and on 23 December Joseph Carruthers, then premier, forwarded to the prime minister (George Reid, a New South Wales representative) resolutions passed by both houses of the State parliament to the effect that (*a*) New South Wales would not grant 900 square miles in any part of the State, (*b*) the true intent of section 125 of the constitution act, as understood by the State, was that the area should be a hundred square miles, (*c*) the government was authorized to offer between 100 and 200 square miles at or near Tumut, Lyndhurst, or Yass, (*d*) the State was prepared to make provision outside such areas for the water-supply of the new capital, (*e*) the matter of railway construction should be carefully arranged, as the State was not prepared to enter into any large expenditure. This peremptory attitude of the State most concerned brought about a deadlock. Tumut had already been deliberately set aside; Lyndhurst was too deeply imbedded in New South Wales territory, too far from the sea, and too awkwardly situated as regards railway approach, to stand a chance of acceptance; Yass had been in the field from the first, and had won no favour at any time. Besides Dalgety was definitely settled on, and the refusal of the New South Wales legislature to consider it seemed to many federal members a form of insolence. Eminent lawyers were agreed that section 125 gave the Commonwealth power to take such territory as it required even against the wishes of the State. But friction was undesirable: in 1905-8 Alfred Deakin was prime minister, and he shrank from any drastic procedure; and the whole matter was put aside for some years.

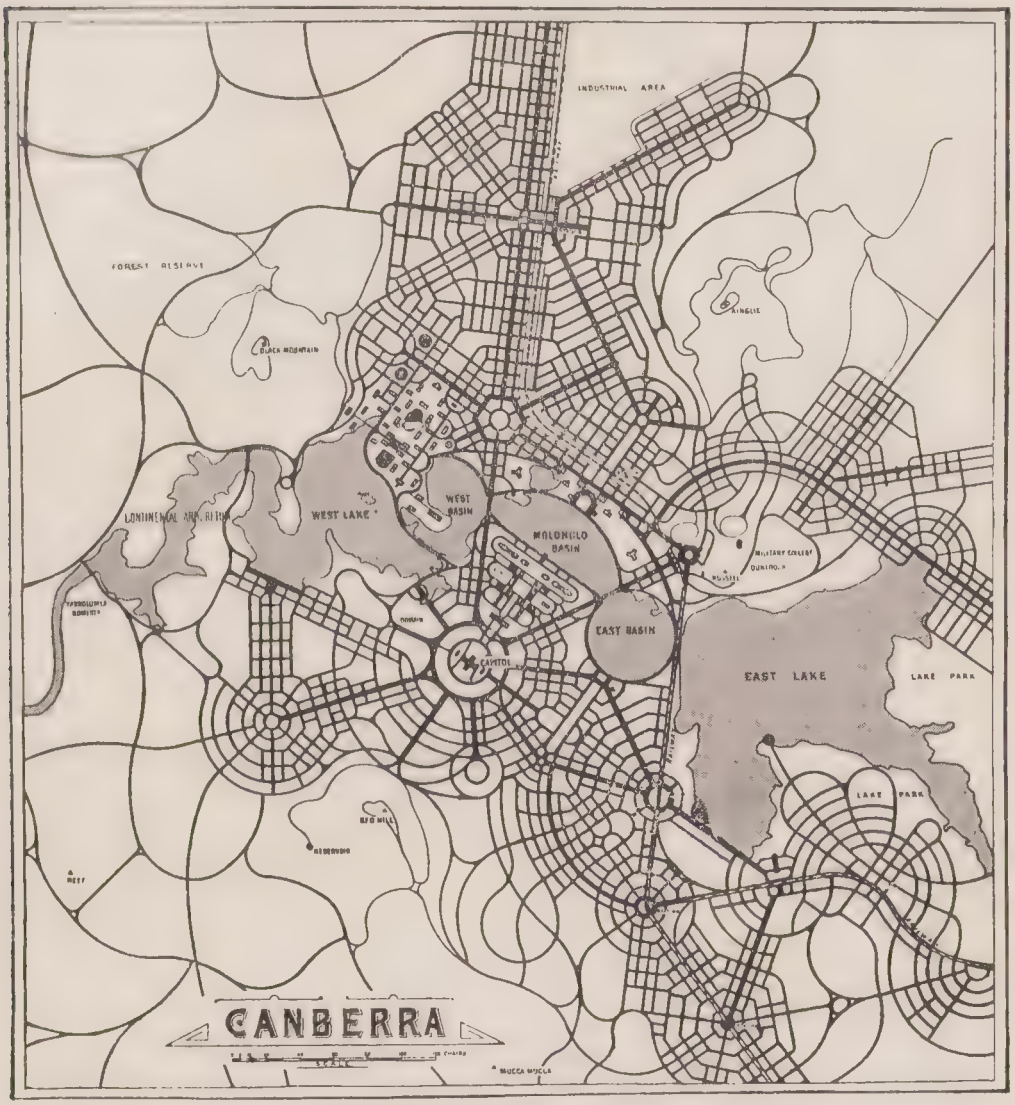
Up to 1907 the Canberra district had not been thought of in this connection, but in that year several New South Wales members of the federal parliament (including J. C. Watson, the leader of the Labour party) passed through it on an angling holiday, and were struck with its suitability for the display of fine architecture and town-planning. When the parliament met in 1908, the question of the capital site was again considered, and to give members an opportunity of finally settling it, a bill 'to determine more definitely the seat of government in the neighbourhood of Dalgety' was introduced on 22 September. Even then it was found impossible to unite all the opponents of Dalgety in favour of any other single site: so the device was adopted of amalgamating for the purpose of the debate two neighbouring but quite distinct sites, and the bill was amended by the substitution of 'Yass-Canberra' for 'Dalgety,' leaving



the choice between the two districts thus joined up for later consideration. The act, which was assented to on 14 December, provided (*a*) that the seat of government should be in the district of Yass-Canberra, (*b*) that the territory to be acquired by the Commonwealth should contain an area of not less than 900 square miles, and (*c*) that the territory should have access to the sea.

Early in 1909, therefore, the Yass-Canberra region was surveyed, and the actual Canberra area found to be the most suitable location for a city worthy to become the capital of Aus-

tralia. It was further recommended that the territory attached to it should include the valley of the Cotter River, an uninhabited catchment fit to provide water for the city, and the valleys of the Molonglo and Queanbeyan Rivers, whose united waters flow through the city area. In March an advisory board (whose conclusions were adopted by the federal government) suggested the acquisition of about 1015 square miles of territory as just described, together with about 2300 acres at Jervis Bay to be made into a federal port. Subsequent negotiations resulted in alterations that excluded the upper Molonglo and Queanbeyan from the new territory, and included a long strip of partially settled country along the Murrumbidgee; acts ratifying the latest agreement were passed by the federal and State parliaments, and on 1 January 1910 an area of about 900 square miles round and south of Canberra, and another of about 4000 acres at Jervis Bay, were constituted the Federal Capital Territory. Of the Canberra territory—583,660 acres in all—about 200,000 acres were then or subsequently acquired



Official Plan of the Capital City.

from their former owners at a cost of about £725,000: this area comprised most of the land lying north and east of the Murrumbidgee, including Acton, Duntroon, Yarralumla, Gungahlin, Tidbinbilla, Tuggeranong, and part of Uriarra, as well as several smaller holdings.

Out of the total area of the Territory about 12 square miles (7680 acres) were set apart for the city site, and about 100,000 acres more reserved for parks, roads, military college, and other public purposes outside the city area. In 1911 the Commonwealth invited designs for the lay-out of the federal city; a board appointed to consider them furnished a majority and a minority report, and another board after consideration of the various designs incorporated features from several of them in a design of its own, which was adopted. The designs most approved of were made by architects from Chicago, Helsingfors, and Paris, and the greater

part of the final design was due to the Chicago planner, Walter Burley Griffin. On 12 March 1913 building operations were officially initiated, the foundation stones of a 'Commencement Column' being laid by the governor-general (Lord Denman), the prime minister (Andrew Fisher), and the minister for home affairs. The military college had already been opened at Duntroon in June 1911, and a naval college—which was in existence, temporarily housed near Geelong in Victoria—established on federal territory at Jervis Bay in 1914. Since then several foundation stones have been laid—notably that of the capitol by the Prince of Wales in 1920. Actual building operations have been much delayed. In 1913-4 a general survey of the site was completed, and certain areas were allotted for early development; the water-supply was also provided for by damming the Cotter River. The war at first hindered and from 1916 onwards put a stop to all activity at Canberra, but in 1921 a committee of five experts in engineering and architecture was appointed to devise a scheme for progressive construction of the city. A great deal of preliminary work has been completed, water mains, sewers, and electric light and power have been installed, and belts of trees have been planted to mark the city avenues and parks. The construction of the great permanent buildings is being delayed until the Commonwealth can afford to spend a good deal of money on them, but provisional buildings are being erected (1924) to accommodate the parliament, the principal departments, and such residents and visitors as a meeting of parliament must attract.

Canberra city lies about 2000 feet above sea-level in 35° 15′ S. lat. and 149° 15′ E. long. It is about 75 miles in a direct line from the coast, 204 miles by rail from Sydney, 429 from Melbourne, 912 from Adelaide, 929 from Brisbane, and 2599 from Perth. Access to the sea will be obtained by a railway 123 miles long, ending in the federal area at Jervis Bay. The average annual rainfall at Canberra is 22.63 inches, the mean summer temperature 67.5° Fahr., and the mean winter temperature 41.8°; it is thus slightly warmer than Melbourne in summer, and cooler than any State capital in winter. Being situated on a tableland instead of on the coast, its four climatic seasons are sharply differentiated, its summer heat is dry, and its winter cold, frosty, and invigorating. The Federal territory extends to within 60 miles of Mount Kosciusko, and includes a cluster of peaks over 5000 feet high.

Statistics.—*Area*: 940 square miles. *Population* (1924), 3677 whites. *Stock* (1922-3): cattle, 6275; sheep, 139,063. *Chief Products* (1922-3): wheat, 7176 bushels; milk, 106,075 gallons; butter, 18,248 lb.

See W. D. Wright's *Canberra*, F. W. Robinson's *Canberra's First Hundred Years*, and the *Official Year Books of the Commonwealth* for 1910 and 1911 (Nos. 4 and 5).

Candle-nut Tree. See ALEURITES.

Candollcaceae, a small indigenous family of herbs or undershrubs, found chiefly in Western Australia. They have a calyx-limb of 5 divisions, free or more or less united in two lips (upper lip 3-lobed, lower 2-lobed); corolla irregular, with 5 lobes, one much smaller than the others; stamens 2, attached to the style and forming a column; capsule opening downwards in 2 valves; leaves usually basal, tufted or rosetted. In the genus *Candollea* (Trigger Plants) the column is curved, elastic and extremely sensitive, a valuable adaptation for securing pollination. When touched by a visiting insect, the column springs sharply back and

Candollea serrulata.

straightens out, flinging the pollen on the back of the intruder, who carries it to the next flower visited and rubs it off on the stigma.

Canterbury, VISCOUNT (1814-1877), John Henry Thomas Manners-Sutton, third Viscount Canterbury, born in London on 27 May 1814 and educated at Eton and Trinity College, Cambridge (M.A., 1835), studied for the bar, but abandoned that profession for politics and in September 1839 was returned to parliament by the borough of Cambridge. Unseated on petition, he was again returned in 1841, and sat for the borough up to 1847; from September 1841 to July 1846 he was under-secretary for the home department in Sir R. Peel's ministry. On 1 July 1854 he was appointed lieutenant-governor of New Brunswick, and held that post to October 1861; on 24 June 1864 he became governor of Trinidad, and on 19 May 1866 succeeded Sir Charles Darling (q.v.) as governor of Victoria. His governorship is chiefly notable for his solution of the 'Darling deadlock;' he was less complaisant to the McCulloch ministry than his predecessor had been, and refused to endorse supreme court judgments in favour of government creditors. In May 1868, therefore, McCulloch resigned, and the Sladen ministry attempted to carry on the government in the face of a vote of want of confidence. During the ensuing political warfare Manners-Sutton loyally adhered to his instructions from the home government, but did not disguise the fact that his sympathies were with the minority ministry. In July the McCulloch party resumed office after an appeal to the country. In November 1869 Manners-Sutton succeeded his elder brother as third Viscount Canterbury. In March 1873 he resigned the governorship, in which he had attained great popularity, and returned to

England where he spoke a few times on colonial questions in the house of lords, and died on 24 June 1877. (K.C.B., 1866; G.C.M.G., 1873.)

Canthium, a large genus of the family Rubiaceae, consisting of shrubs often arborescent, and chiefly tropical. The flowers are in clusters; calyx toothed, corolla-tube short, 4-lobed; fruit a compressed, globular drupe with one or two stone-like seeds; branches sometimes thorny. The following species are suitable for turnery and cabinet work: *C. buxifolium,* wood light-coloured; *C. coprosmoides,* wood dark yellow, streaked with brown; *C. latifolium,* a close-grained, highly ornamental timber, pinkish with darker streaks; *C. lucidum,* a tough and nicely-marked yellow wood. The wood of *C. olcifolium* is capable of a high polish.

Cape, William (1773-1847), born at Ireby in Cumberland, was for many years manager of a leading London bank, and, finding it difficult to maintain his family in England after the bank went into liquidation, decided in 1821 to migrate to Australia. This decision was mainly due to the advice of Thomas Hobbes Scott (q.v.), just returned from Sydney, where he had been acting as secretary to J. T. Bigge; and Scott's influence, together with that of his brother-in-law Lord Oxford, who had been a customer of the bank, assured Cape a welcome in Sydney and the usual grants of land. In January 1822 he with his wife and seven children sailed for Hobart, where he intended to settle, and reached it on 27 May; almost immediately, however, he sailed with his eldest son for Sydney to prosecute a case against the master of a vessel with whom his passage had been booked, but had been cancelled through the master's default. Having won his case and presented his introductions, he was advised by Governor Brisbane to postpone the selection of his land-grants and accept the headmastership of a public school about to be established in Castlereagh-street. Bringing over his family from Hobart, he took over in February 1823 the Sydney Academy (see Schools) from the executors of its founder Isaac Wood; in April 1824 he took the headmastership which Brisbane had offered, and introduced into the new school Pestalozzi's methods of primary education. The work was carried on successfully for two years in the upper rooms of the old court-house (afterwards a girls' high school, and since demolished); but in 1826 Archdeacon Scott, according to Cape, 'reduced this most flourishing establishment to a mere Parochial School of St. James,' and Cape handed the school over to his son William Timothy Cape (q.v.), and applied for his land-grants. Brisbane gave him 2000 acres, and his two elder sons 500 acres each; complications arose, Darling and his secretary Macleay were less friendly than Brisbane and his secretary Goulburn had been, and for another 20 years Cape lived, a man with a grievance, on his farm at Wyong Creek. From 1826 to 1840 he published weekly weather tables in the *Monitor* (and from 1832 to 1838 in the *Herald*) which, filling as they did a gap when there were no official weather records, have been valuable to later meteorologists. He died at Sydney on 19 November 1847. One of his daughters adopted her father's profession, and kept a girls' school in O'Connell-street during the thirties.

Cape, William Timothy (1806-1863), eldest son of William Cape mentioned above, was born at Walworth in Surrey on 25 October 1806 and educated at Merchant Taylors' school, London. He accompanied his father to Tasmania early in 1822 and to Sydney in June of that year, and assisted him at both the Sydney academy and the Sydney public school. When the elder Cape resigned his headmastership in 1826, W. T. Cape succeeded him as headmaster and retained the post till he also resigned in July 1829. At the end of that year he opened a private school at the corner of King- and Phillip-streets, and for the next five years was engaged in training most of the colony's promising youth; but at the end of 1834 he was persuaded by the trustees of the Sydney college (since known as the Sydney Grammar School —see Schools) to take the headmastership of their new institution. With 60 of his pupils he migrated to the new building on College-street, and in seven years built up the reputation of the grammar school. In 1841, however, he quarrelled with the trustees for spending their money on buildings instead of providing adequate salaries for the staff, refused to renew his engagement as headmaster, and next year opened a school of his own in Glenmore-road, Paddington; this he carried on until 1856, when he retired from educational work and in 1859 was elected by Wollombi (the constituency in which his father's farm lay) to the legislative assembly, becoming about the same time a commissioner of national education and a fellow of St. Paul's College within the university of Sydney. In 1860 he found these appointments uncongenial, resigned them all, and returned to England to complete the education of his children. There he died of smallpox on 14 June 1863.

Cape was a great teacher, not so much because of his learning—which was adequate but not profound—as because of his personality and his entire devotion to the character-building side of his work. His aim was to provide the community with great citizens, whether as judges, legislators or unofficial leaders of society, and his training was so devised as to fit his pupils for exerting the influence he prognosticated for them. Among them were James Martin, William Forster, James Dowling, John Robertson, and Thomas Browne whom we know as Rolf Boldrewood, besides several Mitchells and Stephens and Broughtons. Nor was he content with influencing schoolboys; he was the founder of the Sydney Mechanics' School of Arts, and throughout his association with it endeavoured to make it a training-school for the members.

Cape Barren Geese. See Ducks and Geese.

Cape Barren Tea. See Correa.

Cape Gooseberry. See Solanaceae.

Cape Pigeon. See Petrels.

Cape Weed. See Noxious Plants.

Capparidaceae, a widespread family of herbs and shrubs (more rarely trees), widely distributed in warm to tropical regions. Six genera with 35 species are indigenous to Australia. The genus *Cleome* has 4 indigenous species. *C. viscosa,* an erect herb with an elongated capsule and yellow flowers with 4 petals, bears a strong resemblance to a cruciferous plant. It ranges from Western Australia to northern Australia, and extends to India. It is used by the aborigines to relieve headaches. In the United States the roots are used as a vermifuge. In India the leaves, boiled in ghee,

are applied to recent wounds. *Apophyllum anomalum,* an almost leafless tree with small fragrant flowers, is an interior species with a hard timber. See CAPPARIS.

Capparis, a genus of the family Capparidaceae, consisting of trees or shrubs distributed over tropical regions, 20 species being indigenous to Australia. *C. Nobilis,* the Mock Orange, is a small tree armed with conical prickles, which ranges coastally from New South Wales to Queensland. It has a hard, light-coloured wood. *C. Mitchelli* (Native Pomegranate), the 'monda' of the central Queensland blacks, is an inland species extending from South Australia to northern Australia. Both species have showy flowers and large succulent fruits; those of *C. Mitchelli,* which have an agreeable perfume, are eaten by the aborigines.

Carandini, MARIE (1826-1894), born at Brixton, near London in 1826, was the daughter of James Burgess and, through her mother, connected with Shelley and with Byron's friend Medwin. In 1833 the Burgess family migrated to Tasmania, where the father died, and Marie in 1843 became the wife of Count Carandini, an Italian political refugee and teacher of dancing. In January 1845 Carandini took his wife to Sydney to receive better musical training than was obtainable then in Hobart; he himself opened a dancing school and frequently appeared on the stage, and Marie began her stage career as Lady Allcash in *Fra Diavolo* on 5 August 1845. For the next nine years she was a favourite on the Sydney stage, usually appearing in light opera, and at the same time studying assiduously under Isaac Nathan (q.v.) and Sara Flower; and when Catherine Hayes, the Irish *prima donna,* visited Sydney, she chose Marie to interpret many of the contralto roles in her operas—e.g. Elvino in *La Sonnambula* and Gennaro in *Lucrezia Borgia.* With Catherine Hayes Marie went to Melbourne, and soon became herself a *prima donna,* singing Leonora (*Il Trovatore*) at the Princess Theatre with great success. In 1859, being invited to Sydney to sing at the opening of the great hall of the university, she took the opportunity to produce *Il Trovatore* at the Prince of Wales Theatre—its first performance in Sydney. In later years she took a concert company which included Sara Flower and Walter Sherwin through Australia and Tasmania, also visiting New Zealand, India and the United States. In 1870 Count Carandini was pardoned by the Italian government and returned to Italy, but died at Modena shortly after his arrival there. Madame Carandini died in 1894. Her daughter, ROSINA MARTHA HOZANAH CARANDINI, born at Hobart on 28 August 1844 and married in 1860 to Edward H. Palmer, was for many years a favourite concert singer and teacher of singing in Melbourne.

Carissa, a mainly tropical genus of the family Apocynaceae, with two species endemic in eastern Australia. *C. Brownii* (Native Scrub Lime) is a much-branched shrub, armed with horizontally simple (occasionally forked) spines, which ranges from the northern rivers of New South Wales up to northern Australia. It has a pleasant, wholesome fruit like a sloe, about half an inch long, containing a milky juice. It is known to aborigines of the Rockhampton district as 'karey.' The wood is hard and clear, and works well. Along the grain there are a number of white, pithy streaks which give it a pretty, dotted appearance.

Carmichael, BARON. Sir Thomas David Gibson Carmichael, first Baron Carmichael of Skirling, son of the 13th baronet, was born in Edinburgh on 18 March 1859, educated at Cambridge (B.A., 1881; M.A., 1884), entered politics as private secretary to Sir G. Trevelyan and Lord Dalhousie, and in 1895 succeeded W. E. Gladstone as member for Midlothian, but left politics in 1900. In 1904 he became a trustee of the national portrait gallery in London, and in 1906 of the national gallery, but resigned both positions on being appointed in 1908 governor of Victoria. Here his term of office was distinguished by the great encouragement he gave to literature and art. In 1911 he was transferred from the colonial to the India office and made governor of Madras, in preparation for the further move —which took place in the following year—to Bengal. It had been decided to cancel Lord Curzon's division of the Bengal province and to reunite it (with the loss of Bihar and Orissa), while removing the capital of India to Delhi; such drastic changes affecting a disturbed province needed great tact in administration, and Lord Carmichael was specially chosen for the task. He governed Bengal until 1917, and has since resided in Great Britain. (K.C.M.G., 1908; G.C.I.E., 1911; G.C.S.I., 1917. Created a baron, 1912.)

Carpet Shark. See WOBBEGONG.

Carpet Snakes. See SNAKES.

Carr, THOMAS JOSEPH (1839-1917), born in Galway in 1839 and educated at Tuam and Maynooth, was ordained priest in 1866, and in 1870 returned to Tuam as professor of rhetoric. Two years later he was appointed dean at Maynooth, becoming professor of theology in 1874, and vice-president of the college in 1880; in the same year he was made editor of the *Irish Ecclesiastical Record,* the official organ of the Catholic Church in Ireland. On 26 August 1883 he was consecrated bishop of Galway. At the request of the Australian bishops he was in September 1886 translated to the see of Melbourne in succession to Archbishop Goold, was invested with the pallium at Rome, and reached Melbourne on 11 June 1887. During his long administration the archdiocese prospered greatly; the number of its priests grew from 55 to nearly 200, many new parishes were formed, new orders of men and women were introduced (necessitating the building of numerous convents, churches, and chapels), and the noble edifice of St. Patrick's Cathedral in Melbourne was completed. His last great work, unfinished at his death, was the foundation and erection of Newman College within the university of Melbourne. In September 1911, when he celebrated his silver jubilee as archbishop, he was made an assistant to the pontifical throne. He died in Melbourne on 6 May 1917.

Archbishop Carr was noted not only as an administrator but as a controversialist; and among his many writings—which include five large volumes and numerous pamphlets—his work on *The Blessed Eucharist* is favourably known in Europe as embodying much original research. His *Primacy of the Roman Pontiff* is also noteworthy. He was a man of gentle demeanour, easily accessible, and much loved by his people. E.M.O'B.

Carrington, EARL. See LINCOLNSHIRE, MARQUESS OF.

Carrot Burrs. See DAUCUS.

Drawn by Patricia Tillyard.

1. *Phalacrognathus muelleri.*
2. *Trichaulax concinna.*
3. *Calloödes mastersi.*
4. *Carenidium leai.*
5. *Notolestus sulcipennis.*
6. *Pedilophorus gemmatus* (x 3).
7. *Stigmodera gloriosa.*
8. *Cyclophanes gloriosus.*
9. *Lemodes coccinea* (x 2).
10. *Aesernia australica.*
11. *Tragocerus lepidopterus.*
12. *Rhyliphora dallasi.*
13. *Dialeptopus echinatus.*
14. *Leto staceyi.*
15. *Charagia ramsayi* (female).
16. *Bondia cascata* (x 1½).
17. *Wingia lambertiella.*
18. *Xylorycta porphyrinella.*
19. *Monopla miltogramma.*
20. *Cizara ardenia.*
21. *Castulo doubledayi.*

(All figures, except Nos. 6,

22. *Scoliacma bicolora.*
23. *Amata annulata.*
24. *Paracrama dulcissima.*
25. *Fodina sarmentosa.*
26. *Agathia lactata.*
27. *Uliocnemis partita.*
28. *Margaronia suralis.*
29. *Hyalobathra minialis.*
30. *Heteronympha merope* (female
31. *Pseudalmenus chlorinda.*
32. *Papilio macleayanus.*
33. *Trapezites symmomus.*
34. *Gynoplistia bella.*
35. *Osca guttata.*
36. *Pelecorrhynchus nigripennis.*
37. *Blepharotes coriarius.*
38. *Chrysopogon crabroniformis.*
39. *Comptosia sylvana.*
40. *Trichophthalma punctata.*
41. *Eristalis pulchellus.*
42. *Amenia leonina.*

. and 16, natural size.)

Carrotwood. See LEUCOPOGON.

Carstensz, JAN. See AUSTRALIA, DISCOVERY OF.

Cartwright, ROBERT (1771-1856), born in England in 1771 and educated at St. Edmund's Hall, Oxford, in 1794 took holy orders and was curate of Bradford in Yorkshire for 14 years. Samuel Marsden (q.v.), during a visit to Yorkshire in 1808, persuaded Cartwright to accompany him back to New South Wales, and obtained his formal appointment as colonial chaplain. Reaching Sydney on 27 February 1810, Cartwright was at once sent to work in the Hawkesbury district, and in June 1811 was made a magistrate for the district. By 1817 the strain of managing such a huge parish was breaking down his health (it is amusing to note that Marsden, who mentions this, five days later suggested that Cartwright should take on his (Marsden's) work also during his projected visit to England) and in December 1819 he was at his own request transferred to Liverpool. Macquarie valued and liked him, and on more than one occasion took him along as a sort of domestic chaplain on tours of inspection: and Cartwright seized the chance of advocating in his sermons then preached 'the justice, good policy, and expediency of civilizing the aborigines . . . . and settling them in townships.' This project he conceived in 1819, put it before Macquarie in a letter accompanied by 'a kind of verse' which has unfortunately been lost, and followed up this by submitting on 18 January 1820 an elaborate plan for a reservation at the Cowpastures, between the Nepean and the Warragamba, with a township near the main road and separate areas allotted to the several tribes. The plan was never carried out, Macquarie preferring (probably to save expense) to establish three small reservations at Elizabeth Bay, George's Head, and Blacktown.

The value of Cartwright's services was in 1824 recognized by the colonial office both in set terms and by the grant of compensations and additional allowances, and in 1825 he undertook also (possibly to improve his still precarious financial position) the headmastership of the male orphan school, which was 'in the most deplorable state of irregularity, disease, and vice.' It took him four years, Archdeacon Scott records, to establish 'a system of unprecedented order and propriety;' and it is hardly to be wondered at that in 1826 he refused to add to his burdens the headmastership of the female orphan school. In 1829 Scott appealed to the governor for the promise of an annuity to Cartwright's widow in case of his death: but under the Whig governments of the thirties the colonial office grew unsympathetic and over-economical, and grudged all concessions to officials.

In 1836 Cartwright resigned the Liverpool cure, and for two years was in charge of St. James's, Sydney. In 1838 he retired from parochial work and settled near Collector, south of Goulburn, where for many years he acted as honorary itinerant preacher for the area to south and west. In 1851 he is described as bishop's commissary. He died at Collector on 14 December 1856.

Carvosso, BENJAMIN (1789-1854), son of William Carvosso the evangelist, was born at Gluvais in Cornwall in 1789, entered the ministry in 1814 and arrived in Sydney in 1820. After spending five years in Windsor, Parramatta, and Sydney he was transferred to Hobart, where he had preached on his way out, being the first Wesleyan missionary to conduct worship in the island. While in Sydney he, in conjunction with Walter Lawry and Ralph Mansfield, edited the *Australian Magazine* and helped to establish a floating chapel for seamen, the first service being held in the brig *Lynx* in November 1822. In 1830 he returned to England and died in Cornwall in 1854.

See Blencowe's *Faithful Pastor* (1859).

J.C.

Cash, MARTIN (1809-1877), born at Enniscorthy in county Wexford, Ireland, was transported to Australia in 1827 for an attempt to murder a rival in a love affair. Reaching Sydney in the *Marquis of Huntly* on 30 January 1828, he was assigned to James Bowman, and by him sent to work on Wybong station in the hills west of Scone (Hunter River valley), where he in due course gained a ticket of leave and then freedom. In 1837 he was detected in branding stolen cattle (innocently, by his own account), and thought it wiser to leave the district: via Mudgee and Bathurst he reached the Goulburn district, and obtained work as a dairyman on Captain Sturt's farm near Mittagong (which he calls 'Meadow Gang'), but quarrelled with an overseer and made his way via Sydney to Tasmania, reaching Hobart on 12 February 1837. Settling at Campbelltown, he soon became notorious as a hot-tempered man who took offence on small provocation and frequently came into collision with the police: in March 1840 he was sentenced to seven years' penal servitude and sent to a penal station near Richmond. At once he escaped: re-captured, he escaped again, and for a year worked in the Huon district (where he was not known) in order to obtain money for a passage to Melbourne. Coming to Hobart to secure this passage, he was recognized, caught, and given four years at Port Arthur for absconding. From this prison he escaped by swimming Eaglehawk Bay, which was supposed to be full of sharks (this, however, was merely a tale invented to frighten absconding convicts): but he was caught again near East Bay Neck, and sentenced to 18 months' labour in the stone-quarry.

Up to this time, apparently, Cash had not contemplated a bushranger's career. But in the quarries he met Kavanagh and Jones, two convicts who had been sent to Port Arthur for bushranging near Sydney, and the three combined to utilize his talent for absconding and theirs for making a living afterwards. They swam the narrow inlet, crawled at midnight past a sentry-box on East Bay Neck, and established themselves in a camp on the Dromedary (north of New Norfolk) from which they raided settlers on the Derwent and its tributaries. From Ross on the upper Macquarie to Lake Echo, and south to the Derwent, no one was safe from their visits, and detachments of soldiers hunted them in vain. In 1843 Kavanagh was wounded, and gave himself up: and on 29 August in that year Cash was caught while on a visit to Hobart, tried on 15 September for the murder of a constable who had been shot in the scuffle, sentenced to death, and reprieved (after 15 months of suspense) to Norfolk Island for life. Kavanagh, tried at the same time for an earlier act of bushranging, received the same sentence and reprieve. On the island, however, Kavanagh within a year joined in a mutiny and was hanged. Cash, by a course of steady good conduct that earned him the favour

of the martinet John Price (q.v.), obtained regular promotion and a pardon, returned to Tasmania when the penal settlement was broken up in 1853, was for a time caretaker at the Hobart botanical garden, put in four years in New Zealand, and finally settled down at Glenorchy near Hobart to write his memoirs and die in the odour of respectability on 27 August 1877.

Our main source of information about Cash is his autobiography published in Hobart in 1870. The dates in this, where they can be checked, are frequently inaccurate, as might be expected, but there is no reason to doubt the general truth of Cash's statements, though he certainly exaggerated some of his sufferings as a convict—e.g. his treatment by John Price at Norfolk Island.

Cassia, a large genus of the family Leguminosae, sub-family Caesalpineae, consisting of trees, shrubs, or herbs, tropical or subtropical, particularly abundant in America. The flowers are yellow, rarely white or reddish; leaves divided into more or less numerous leaflets; pod flat or cylindrical. Many species are cultivated as ornamental shrubs. *C. absus* has bitter aromatic seeds, a preparation of which is used in Egypt for ophthalmia. The pods and leaves of *C. eremophila* are eaten by stock. *C. Brewsteri* (Queensland Laburnum) has a pale yellow wood, close-grained and nicely marked. The senna of commerce is obtained from several species, mainly from two growing in Egypt and India respectively; and von Mueller thought that the leaves of *C. artemisioides,* an inland Australian species, might be found effective in a similar way. Cassia bark, it should be noted, is not connected with this genus, being a product of *Cinnamomum cassia.*

Cassinia, a genus of the family Compositae, consisting of ornamental shrubs with white or yellowish shining bracts. It is represented by several species in New Zealand, and by one in South Africa, but all the Australian species are endemic. The involucre is oblong, bracts scarious or coloured; seeds short, angular or cylindrical, usually papillose with a pappus of entire or minutely denticulate bristles in a single row, cohering only at the base. *C. aurea* has a graceful habit, and produces a profusion of pale golden flowers. *C. laevis* has a dark, close-grained wood, while that of *C. aculeata* is white.

Cassowary, a genus (*Casuarius*) of large flightless birds, constituting the family Casuariidae, found in the tropical scrubs of northern Queensland and in New Guinea, the Aru Islands and Ceram. The Queensland species (*C. casuarius*) is characterized by its large bony helmet or casque, and by the pendent red wattles on the front of its neck. The head and neck are otherwise practically naked, the skin being bright blue with an orange patch at the back of the neck. The body is clothed with black, hair-like feathers, double as in the emu (q.v.), and the wings bear some large hollow black spines. The cassowary lays 3 to 6 pale green, granulated eggs, usually somewhat larger than those of the emu, in a nest built up of sticks and leaves on the ground in the scrub, often at the foot of a tree. The breeding-season is from July to September, incubation occupying about two months. The young birds are yellowish-brown, with longitudinal black stripes.

Cassowaries are shy birds, feeding on jungle fruits; the bony casque, which is directed forward, protects the bird's head as it makes its way through the thick undergrowth in which its food is found.

The name is of Malay origin, the bird having been known in the Moluccas from a remote period. In New Guinea and the adjacent islands

Cassowary.

there are numerous species and races, differing among themselves chiefly in the coloration of the neck and the form of the helmet and wattles; it is possible that more than one race is to be found in Queensland.

The first cassowary seen in Australia by white men was shot by the aboriginal Jackey near Princess Charlotte Bay on 4 November 1848, during Kennedy's ill-fated expedition to the Cape York Peninsula, and its skin was brought to Weymouth Bay by Thomas Wall, the naturalist attached to the expedition. According to Carron, one of the survivors, two more birds were seen during the journey. The first living specimen, however, was not captured until 16 March 1871. See EMU.

W.B.A.

Cassytha, a genus of the family Lauraceae, chiefly Australian and largely maritime, consisting of leafless parasites with wiry stems, which attach themselves to living plants by means of small suckers (haustoria). The small flowers are arranged in clusters, and the seeds are enclosed in the enlarged succulent calyx-tube; leaves replaced by minute scales. There are 12 indigenous species, about equally divided between east and west, one species, *C. glabella* (Devil's Twine), being found in all the States. *C. filiformis* (Dodder Laurel), which extends from Queensland to northern Australia, has a wide tropical range. It is used in India by the Brahmins for seasoning buttermilk. Crushed with gingelly oil, it is used as a wash for strengthening the hair.

Castanospermum, a genus of the family Leguminosae, consisting of one species, which is endemic in Australia—*C. australe* (the Moreton Bay Chestnut, Bean-tree or Black-bean), a tall tree which reaches its southern limit on the northern rivers of New South Wales. The leaves are 1-1½ feet long with from 11 to 15 leaflets; flowers large, orange-red, in loose clusters; pod large, swollen, almost woody, spongy inside; seeds large, globular. The beans are used as a food by the aborigines, who prepare them by first steeping them in water from 8 to 10 days. They are then

taken out, dried in the sun, roasted upon hot stones and pounded into a coarse meal; the meal may be kept for an indefinite period. When required for use the meal is mixed with water, made into a thin cake, and baked in the usual manner; the cakes taste like a coarse ship's biscuit. A sample of starch made from these beans was exhibited at the Melbourne Exhibition in 1866. They are suspected of poisoning stock,

Moreton Bay Chestnut.

but no poisonous property has been isolated; it is suggested that any injury suffered by stock from eating them has been due to their indigestibility. The timber is soft, fine-grained, and takes a good polish, but is not durable. Somewhat like walnut, it is used for cabinet work. The tree is a common feature in our parks and gardens.

Castor Oil Plant. See NOXIOUS PLANTS.

Casuarinaceae, a family of self-pollinated trees or shrubs with uni-sexual flowers, the males in elongated cylindrical spikes that terminate the branchlets, the females axillary in dense ovoid or globular heads, sessile or shortly stalked. The fruit is an ovoid or cylindrical cone; seed a laterally compressed nut, smooth and shining, produced at the apex into a membranous wing which assists dispersal. The striated or ribbed branchlets, with verticillate whorls of teeth (representing reduced leaves) which form a collar round the joints, bear a striking resemblance to the Horse-tails (*Equisetum*) of Europe. The number of teeth in the whorl affords a useful character in classification. The family is represented by a single genus containing 29 species, most of which are endemic in Australia—13 are confined to Western Australia—but a few extend over tropical Asia from East Africa to the Malay Archipelago and South Pacific islands. In Western Australia they come second only to the eucalypts in height. The trees of the genus have a corky, corrugated bark, and some are valuable fodder-plants. The family is of special interest as forming a link with primitive vegetation, since a *Casuarina* has been recorded in the Mount Vernon Tertiary beds of North America. They occur in dry rocky country, in saline soils both coastal and inland; the largest trees mark the courses of our eastern rivers. *C. torulosa* (She-oak) is a tree of 50-70 feet, found on the coast and in the ranges of New South Wales and Queensland; it has smooth branchlets and flat-topped globular cones, and its tough wood is well adapted for furniture and veneers as well as for staves and shingles—it also burns well. For an explanation of the name see SHE-OAK. *C. stricta* (Drooping She-oak, sometimes called He-oak or Beefwood), a tree with drooping foliage which has an acid taste when chewed and is said to allay thirst, occurs in all the States except Queensland, and is a useful fodder plant in times of drought, as stock browse on it eagerly. Plants are easily raised from the seeds, which are closely packed in large ovoid cones. The timber is used for bullock-yokes, wheel-spokes and axe-handles. *C. Cunninghamiana* (River Oak), one of the largest species—it sometimes reaches 100 feet—is found in the coastal districts of New South Wales and Queensland, as well as on the dividing range and the western slopes, and

Belar.

reaches its maximum growth on the banks of freshwater rivers. It has small cylindrical cones, flattened at both ends, and very slender branchlets. It is one of the best fodder-trees in the genus. Its hard and prettily marked timber is used for shingles, staves, etc. *C. glauca* (Swamp Oak, Saltwater Swamp Oak) forms forests on the margins of salt-marshes or tidal rivers. In the latter station it acts as host for several parasitic mistletoes; one prevalent species (*Loranthus linophyllus*) has cylindrical leaves mimicking those of its host. The epiphytal Pencil Orchid

(*Dendrobium teretifolium*)—which also has cylindrical leaves—forms large clumps on the trunk, and the bark is draped with varicoloured lichens. The fruit is a small globose cone; nuts grey (in other species they are dark-brown). Its timber is useful where toughness and lightness are requisite. *C. equisetifolia* (Iron-wood, Bull Oak) is a northern species, extending to India and the Pacific islands. The bark is astringent, and has been used in cases of dysentery. The islanders dye their cloth with it, and make clubs of its wood. Its coarse-grained and beautifully marked timber lasts well when used for jetty-piles, for underground work, and for the knees of boats. In India it is used for fuel on the railways, and large plantations have been established near Madras to supply it. *C. suberosa* (Black She-oak), found in all the States except Western Australia, is a coastal or mountain species, and does not extend to the inland plains. Its timber is used for shingles, tool-handles, etc. *C. Luehmanni*, a warm-country species, ranging from Queensland to South Australia (its spread easterly is interrupted by the cold climate of the highlands of the dividing range), is easily distinguished by its broad, flat-topped cones. *C. lepidophloia* (Belah, Belar) is the commonest *Casuarina* of the interior, usually found in 'gilgai' country—i.e. low-lying land with natural basins subject to inundation. The timber is much used for fencing posts. *C. nana*, a small shrub occurring in alpine and sub-alpine regions, forms a considerable percentage of the shrubby vegetation on the bleak windswept ridges of the Blue Mountains. *C. Decaisneana*, the commonest species known in central and north-western Australia, has very large cylindrical fruits, occasionally three inches long. Its timber is very hard and resists white ants.

Cat-birds. See BOWER-BIRDS.

Catchpole, MARGARET (1762-1819), daughter of a farm-labourer, born at Seven Hills near Ipswich in Suffolk on 14 April 1762, became locally famous at the age of 24, when she galloped a spirited pony bare-back to Ipswich to fetch a physician for the sick wife of her father's employer. This exploit procured her the position of maid-servant in the family of an Ipswich brewer, Cobbold by name; but, falling in love with a young smuggler, she in 1797 stole a horse from the Cobbold stable and rode it to London (70 miles away) in 8½ hours. There she was caught, tried for the robbery, and sentenced to seven years' imprisonment. In 1800 she broke out of Ipswich gaol to rejoin her lover, but was recaptured and sentenced to death, the sentence being commuted to one of transportation for life. On 14 December 1801, according to one account, she arrived in New South Wales by the transport *Nile*, and shortly afterwards entered domestic service, being assigned as a cook to John Palmer the commissary (q.v.). Here, it would appear, she met the young botanist George Caley (q.v.), who asked her to marry him. But she was resolved never to marry: her smuggler lover had been killed in attempting to protect her against recapture in 1800, and she remained faithful to his memory.

From 1804 onwards she worked in the Hawkesbury district as a midwife, attending among others the wives of Richard Rouse (q.v.) and John Dight. During the Hawkesbury flood of March 1806 she was staying with the Dights; later in the year Rouse was made superintendent of the Parramatta lumber yard, moved with his family to the town, and left Margaret in charge of his farm. But she tired of the lonely life, returned to Sydney in October, and thence went to nurse the wife of William Faithfull, who had married a daughter of Thomas Matcham Pitt, a distant cousin of Lord Nelson's. She was thus in intimate relations with several of the best-known pioneer families of New South Wales. In December 1806 she was established in a cottage on Richmond Hill above the Hawkesbury, keeping a few sheep and goats and trading in dress stuffs and haberdashery among the neighbouring settlers. These occupations, combined with midwifery, seem to have sufficed her until she died on 13 May 1819.

The above facts are, it is believed, accurate. But the various accounts of her life are full of discrepancies: for instance, Henry Fulton, the clergyman who buried her, in his burial register recorded her age as 58 when—if we may trust her own statements—she was only just 57. It is Fulton, too, who says that she came out in the *Nile*; but official records do not admit the presence of any female convicts aboard that vessel, and Fulton may have argued that, as the Rouses came out in the *Nile*, Margaret probably came with them. Again, the earliest account of her life, written by Richard Cobbold (son of the Ipswich brewer), gives her birth-year as 1773: this was probably to heighten the romance, since the adventures of a woman of 35 who broke prison at 38 would not appeal to Cobbold's readers like those of a girl of 24-27. Margaret's name would probably have sunk into oblivion like those of the mass of her fellows had not Cobbold chosen her for a heroine and —apparently with deliberation—amalgamated her career in New South Wales with that of Mary Haydock (afterwards wife of Thomas Reiby, q.v.) a Lancashire girl who was transported in 1792 for a similar but more innocent exploit with a neighbour's pony. Cobbold in a later edition apologized for his mistake—to which the Reiby family had strongly objected; but unfortunately the Cobbold version of the story has been given in the *Dictionary of National Biography*, and therefore needs definite contradiction. Cobbold even invented letters supposed to have been written by Margaret Catchpole to friends in England years after her death. W.J.

Caterpillar-eaters. See CUCKOO-SHRIKES AND CATERPILLAR-EATERS.

Catfish, a name applied to a very large group of fishes known as the Siluroidea, which is plentifully represented in both fresh and salt waters in many parts of the world. The siluroids are armed with strong barbed spines in their pectoral, ventral and dorsal fins, with which they inflict severe wounds if handled incautiously. The mouth is encircled by long feelers (barbels), and it is from their supposed resemblance to the facial vibriciae of a cat that the vernacular name is derived. Though often regarded with repulsion on account of their scaleless and slimy bodies, catfishes are good for food, and a species that occurs in the rivers of New South Wales (*Tandanus tandanus*, commonly known as 'jewfish') is a valuable addition to the table of the man on the land. This species, like many of its allies, builds a nest of pebbles, in which its eggs are deposited and guarded by the parent fish until they hatch. Other species, such as the salmon catfishes of the family Ariidae, carry their eggs in the mouth, and even the young are so sheltered in their early stages. The salmon

catfishes have a forked tail and a small dorsal fine, whereas in other siluroids the tail is pointed and the adipose fin is lacking.

The catfish neither resembles nor is related to the marine jewfish, q.v. A.R.McC.

Cattle. *History.*—Of the few cattle first introduced from the Cape by Phillip, four cows and two bulls strayed from the settlement and were lost; the one cow left became so wild that she was killed and eaten. In 1791, however, H.M.S. *Gorgon* brought out three bulls and 23 cows, and others were obtained from India. Cattle from the Cape were always referred to as 'black cattle.' Major Johnston records the fact that the small Indian cattle, when crossed with Cape bulls, produced an offspring superior in size and quality, but bad milkers. In 1793 the public stock of cattle at Parramatta numbered three bulls, two bullocks, 15 cows and three calves. In January 1794 Collins relates that 'one small cow and a Bengal steer, were killed . . . . The beef was deemed worth eighteenpence per pound, and was sold to the soldiers. The two animals together weighed three hundred and seventy-two pounds. . . . . This was but the third time that fresh beef had been tasted by the colonists.' The same writer says 'An English cow, in calf . . . . was sold by one officer to another for eighty pounds; and the calf, which proved a male, was sold for fifteen pounds.' In November 1795, in consequence of the reported existence of the cattle lost in 1788, Hunter led a search party from Parramatta, and after crossing the Nepean 'to his great surprise and satisfaction, fell in with a very fine herd of cattle . . . . . upwards of sixty young and old' . . . . A bull was killed which 'had all the marks of the Cape cattle when full grown, such as wide-spreading horns, a moderate rising or hump between the shoulders, and a short, thin tail. . . . . It was a pleasing circumstance to have in the woods of New Holland a thriving herd of wild cattle.' The district has ever since been known as the Cow-pastures.

In 1796 the cattle (excluding the wild herd) numbered 229, and in 1800, 1044. In 1803 the government herds had 1530, and the settlers 650. In 1804 King reported a disease among the cattle, 'a spongy substance on the tongue . . . . bad feet . . . . . all those of Government's have recovered, but, I am sorry to say several belonging to individuals have died'—probably from the 'foot and mouth' disease often so disastrous later on. Referring to the breeds of cattle in the colony King stated that an Andalusian cow was left by Commodore Malaspina in 1794, and another was brought from St. Catherine's. A few were of 'the English breed from St. Helena.' In 1807 the breeds of English cattle in the colony were Longhorn, Devon, Ayrshire, Shorthorn, Red Norfolk, and polled Dun Suffolk. Probably many of the cows then introduced were shipped to supply milk on the voyage.

Macquarie in 1811 wrote:—'The Horned Cattle belonging to Government in the tame Herds are not fewer than three thousand six hundred of all Descriptions; the preserving of these tame Herds I consider to be of the Utmost Importance, and, therefore, should, in my Opinion, be persevered in for Several Years to Come, as well for the Benefit of the Crown as for the great Assistance derived from them by the new Settlers, who . . . . . by purchasing from Government at a moderate Price, and on a liberal Credit, are enabled to acquire Herds and Wealth to themselves, and to pay Government at the end of Eighteen Months or two Years, either in money or in kind, as may best suit their Convenience.' Again on 18 March 1816 he wrote:—'In consequence of the Very great Mortality which has taken place in the Government Herds, as well as in those of Individuals, during the last three Unfortunate Years of Drought, I was Induced to grant Permission to several of the great Stock-Holders in the Colony to send their Horned Cattle across the Blue Mountains to Graze in the New discovered Country and I also sent Some Herds of the Government Cattle thither as an Experiment. I have now the Pleasure of reporting to Your Lordship that both the Government Cattle, and those belonging to Individuals, have greatly benefitted Already by the Change, and the Whole Wonderfully Improved both in Size and Appearance owing to the Abundance of rich Grass and Water to be Met with in all parts of that Country.'

In 1820 there were 54,103 horned cattle in the colony. John Macarthur's according to Atkinson, were of the Lancashire, and Samuel Marsden's of the Suffolk (polled) breed; these two were perhaps the most unmixed herds in the colony. About 1840 Gipps stated that 'Our flocks and herds already stray over a country 500 miles long by 300 miles wide; and I hesitate not to say that any attempt to bring them within the limits even of our twenty contiguous counties would end in failure, if not in the ruin of the country.' The stock reported at the end of 1839 were 7088 horses, 371,699 horned cattle, and 1,334,593 sheep; the real numbers in all probability were greater.

In 1843 a financial crisis made stock almost unsaleable. At the critical moment Henry O'Brien, a squatter in the Yass district, suggested that surplus stock should be boiled down for tallow, and the hides and skins exported. This method of utilizing sheep had been already tried in 1838 by Frederick Ebsworth, an employee of the Australian Agricultural Company, and had proved profitable; it was now used also for cattle with good results, and for some years they were so treated to the extent of 40,000 per annum. The number of horned cattle in the colony was then 1,017,316; notwithstanding the bad times they increased in 1844 to 1,159,432 head. About 1862 a severe outbreak of pleuro-pneumonia occurred, so that in 1863-4 the number of cattle dropped from 2,620,383 to 2,032,522. As about that time cattle were being replaced by sheep on many stations, there was a further decrease to 1,771,809 in 1866, and in 1867 to 1,728,427. The pleuro-pneumonia was in the end checked by inoculation (great losses were at first caused by rough methods and impure virus), and in 1870 the two-million mark had again been passed.

In that year, according to an official report 'The principal breeds of Great Britain—Shorthorned or Durham, Hereford and Devon—are to be found here in perfection. Pedigree stock is much sought for and realizes high prices . . . . the colonial-bred animals are allowed to compete without restriction with the imported at Agricultural Shows, although formerly imported and colonial breeds were classed separately. . . .'

In 1895 the chief inspector of stock reported that both the quality of the cattle and the stockowners' ideas about breeding had undergone great improvement, while runs had been enclosed and subdivided, heifer-paddocks formed and large numbers of pure-bred stock, high-

priced and of high quality introduced; consequently the beef cattle of both New South Wales and Queensland could in ordinarily good seasons compare favourably with those of any other part of the world. Black polled and improved red polled herds had by that time been established in New South Wales.

The number of cattle registered in New South Wales (including the Federal Capital Territory) shows no regular growth, as the following table will testify:—

1875	3,134,086
1890	2,091,229
1905	2,337,973
1920	3,375,267
1922-3	3,251,180

Victoria.—The first cattle introduced into the Port Phillip district were taken by Edward Henty (q.v.) to Portland Bay in November 1834, and consisted of 13 heifers and four working bullocks. Shortly afterwards 16 more cattle were brought from Tasmania, and in the following year Batman and others introduced Tasmanian cattle into the Port Phillip country; not long afterwards the Sydney-side squatters began to travel their herds southwards from the Murrumbidgee and Monaro districts. In 1836 Port Phillip reported 188 head of cattle; but in 1838 there were 13,272, in 1841 50,837, and in 1843 160,792, many of which had been brought overland. Of these 45,520 were on runs in the Murray valley, 23,779 in Gippsland, 24,432 in the area bordering Port Phillip and 53,453 on the western plains.

To secure a good area of the much-desired 'western country,' it was advisable to have herds justifying the need of such an area. The demand for stock, therefore, was immense, and the price of cattle rose in proportion. In 1846 the cattle had increased to 231,602, and a considerable amount of beef was cured for export, chiefly to Tasmania. In 1850 there were 346,562 head of cattle in Victoria and the output of tallow was 10,009,246 lb., valued at £132,403. The influx of population that followed on the discovery of gold, and the substitution of sheep for cattle over a large portion of the country, tended to improve the price of cattle and encouraged the holders of cattle-runs to improve the character of their stock. The cattle originally bred in the colony consisted of shorthorns and Herefords; but the taste of Victorian breeders was always for the shorthorn, and gradually the herds of Herefords were reduced, stud herds of shorthorns were formed, and animals of high lineage were imported from England. At a later date (about 1890) polled Angus cattle were imported, and came into favour because the climate suited them. By 1870 the breeding of stud bulls was progressing, and many fine animals were exported to other colonies; the New South Wales chief inspector of stock reported in that year that 'next to English stock, the colony has been indebted to Victoria.'

In 1860 the cattle numbered 722,332 head, including 197,332 milch cows. In 1870 the total number was 776,727 head (212,193 milch cows), and of these 80 per cent were in the hands of farmers, as the best portion of the old runs had been taken up by selectors. In 1880 there were 1,286,267 head in Victoria, including 329,198 milch cows; in 1890 the total number was 1,782,978; and the number has remained fairly steady at this figure until the present time, the total for 1922 being 1,785,660; the proportion of milch cows, however, has increased considerably, from 25 per cent of the total in 1880 to 35 per cent in 1922.

Queensland.—Although Allan Cunningham opened up excellent cattle-country west of the main range in Queensland as early as 1827, it was not till 1840 that squatters took any advantage of the discovery. In that year Patrick Leslie, Arthur Hodgson, John Cox and others moved northwards from New England and the Hunter valley on to the Darling Downs, and cattle-runs soon began to spread north and west over the watersheds of the Macintyre and Condamine. By 1859 there were nearly 433,000 cattle in Queensland; within five years that number had doubled, and within 25 increased tenfold. There was great rivalry between cattle-owners and sheep-owners, as in the western States of North America, but their mutual dislike did not develop into violence. In 1890 the cattle-tick (q.v.) began to spread in the coastal districts; and in 1891 record of 6,822,401 cattle in the colony was by 1900 diminished to 4,078,191. Values also were very low—whereas in South Australia and Victoria cattle fetched from £8 to £10 per head, and in New South Wales from £5 to £8, Queensland prices ranged from £3 to £4. De Satgé's *Journal of a Queensland Squatter*, describing conditions about the end of last century, notes that on the Logan River south of Brisbane, and in the Moreton Bay district, cattle country was mainly freehold, and the cattle largely used in dairying; farther north there were many cattle-stations in the Burnett, Isaacs, and Burdekin valleys, and the Cape York Peninsula was almost exclusively taken up with cattle. On the rivers running into the Gulf of Carpentaria there was excellent cattle-country only half-stocked; the boiling-down establishments at Normanton and Burketown were primitive, and those at Townsville and Bowen out of reach. The coastal runs were well served in this respect, with factories and freezing-works at or near Brisbane, Toowoomba, Gladstone, Rockhampton, and St. Lawrence, besides those already mentioned. The inland areas were served by similar establishments at Charleville, Barcaldine, Longreach, and Hughenden. All northern and western cattle were travelled to market on the hoof.

Since 1900 the situation has not altered in essentials, though the number of cattle has increased considerably and their quality has to some extent improved. The following figures tell their own story:—

1900	4,078,191
(1902 and 1903 were drought years)	
1905	2,963,695
1910	5,131,699
1915	4,780,893
1920	6,455,067
1922	6,955,463

For many years Queensland has contained from 45 to 49 per cent of the cattle of the Commonwealth.

South Australia.—The first supplies of stock for South Australia were obtained from Tasmania and New South Wales. In 1838 the first mob of cattle arrived overland from New South Wales; this was considered an event of such importance that it deserved celebration with a dinner at which 90 guests feasted on an ox chosen from the herd. The mob comprised 335 head and was in charge of Joseph Hawden who during the journey of 10 weeks lost only four bullocks. The second mob was brought over by E. J. Eyre, and the third by Captain Sturt. In 1838 there were 2500 cattle in the colony;

two years later they had increased to 15,000, and during the next decade that number was quadrupled. In 1860 the cattle numbered 278,265, but five years later there was a great falling off; in 1870 the number was reduced to 136,832, and it took 10 years to recover and pass the record of 1860. By 1895 there were 636,824, but 280,957 of these were running in the Northern Territory, then under South Australian administration, which from 1885 onwards was being stocked from Queensland. From this time forth cattle-raising on an extensive scale was restricted to 'outside country' (i.e. to the salt-bush plains of central Australia and the Territory). In 1900 South Australia proper held 214,761 cattle; in 1910 384,862, and in 1922 425,811. Some fine stud cattle—chiefly shorthorns and Herefords—are produced in the State, the chief studs being those formed by the late J. H. Angas in 1848 with pure-bred stock brought from England by the South Australian Company.

Western Australia.—In 1832 the settlers in Western Australia had about 500 head of horned cattle; but, what with the natural increase and an importation from Tasmania in 1840 (when cows realized £21 and heifers £15 a head) the number in 1845 was 10,910 head. In 1861 vast areas of excellent grazing country were discovered along the north-west coast by F. J. Gregory (see EXPLORATION BY LAND). In 1863 live stock were first shipped from this region, and the country was soon taken up and stocked as far north as Cambridge Gulf and Kimberley. The latter district was in 1893 the best cattle-country of the colony, and held over 150,000 head. Cattle were frequently travelled across from Queensland, and a good stock-route was gradually opened up between the two colonies. By 1911, 75 per cent of the State's cattle were being raised in the north, Kimberley alone carrying five-sixths of these. Cattle were conveyed to Fremantle in specially fitted-up vessels, or might travel overland by well-watered stock-routes. Of these there are no less than 3015 miles on which the government maintains 242 wells, on the average about 12½ miles apart. The annual maintenance costs £3500, and the capital cost was about £82,500; no direct revenue is obtained from them (see WATER SUPPLY). About 23,000 head came annually by sea; a rough estimate set down the overlanded cattle at 'several thousand;' but many of the cattle travelling by both routes were brought from the Northern Territory.

In 1911 the commissioner of tropical agriculture reported that 'when compared with Queensland, Kimberley cattle are undergoing a process of deterioration. . . . On a number of runs, more particularly the smaller runs, degeneration is evident; the cattle are getting deplorably inbred and show it in reduced size, lighter skin, and weakened constitution. They mature tardily, fatten slowly and calve poorly. . . . Unless the graziers are able to introduce well-bred stud bulls the majority of the cattle will only be fit for canning, a smaller proportion for freezing, and only a few will come up to the chilled meat standard. . . The difficulty is aggravated by the presence of ticks in East Kimberley.' About the same time many station-owners, particularly in the Gascoyne district, substituted sheep for cattle, as more suitable for the class of country, and more profitable on account of the greater certainty of returns. But the consequent decline in numbers was only temporary, as the following figures show: number of cattle in Western Australia:—

1900.....338,590	1912.....806,294
1905.....631,825	1916.....863,930
1910.....825,040	1920.....849,803
	1922.....939,596

Northern Territory.—Cattle were first introduced into the Territory in 1824, when a military settlement was established on Melville Island. In 1826 the settlement had 16 head of horned cattle, and 16 buffaloes for slaughter had just been landed from Timor. During the first four years two-thirds of the cattle died in 10 or 14 days after being landed, but the survivors did very well. The Timor buffaloes herded apart from the English cattle. They were left on the island when the settlement ceased to exist, increased rapidly, and have for many years been hunted and killed for their hides.

The occupation of Raffles Bay in 1827 involved the introduction of a few English cattle and Timor buffaloes (q.v.), as did that of Port Essington eight years later. In 1841 the commandant at the latter port reported that the buffaloes were dying of the distemper, while the descendants of those left at Raffles Bay, a few miles away, were increasing rapidly. The oxen escaped this scourge. They seem to have been mostly Durhams, and in 1883 had deteriorated very little—a fact which speaks volumes for the suitability of the climate and country for cattle-breeding.

The first cattle brought overland from Queensland arrived in 1872. In 1886 the area held under pastoral lease was 270,024 square miles, and the area declared stocked 183,833 square miles. Red-water was showing itself across a belt of 130 miles between the Roper and King, and ticks were becoming troublesome. In 1892 the export of cattle to the East was initiated by a Sydney firm, aided by a government subsidy of £5000 per annum. During that year 1536 head of cattle were exported; in 1895 the number of stock shipped to the East was 2382. In 1897 the agreement terminated, the southern markets were closed owing to quarantine restrictions, and the industry fell on evil days; but in 1899 the prohibition against importing Territory cattle into Western Australia was removed, and in 1900 8490 head of cattle were exported. The Eastern market, however, had disappeared, and, though in 1909 37,492 cattle (valued at £168,261) left the Territory, the other States were the only available market.

In 1911 the Territory came under the federal government; under its auspices extensive freezing-works were erected near Darwin in 1917, and proved a boon to pastoralists, who were further aided by the railway extension from Pine Creek to the Katherine River. But labour troubles led to a dearth of shipping and ultimately to the closing of the works in 1920, and the Territory is again dependent on travelling its stock to market. Five gazetted stock-routes, aggregating 2121 miles, are well supplied with bore water.

The following figures depict the growth of Territory herds since statistics were first taken:—

1880..... 19,720	1910.....513,383
1890.....214,094	1920.....659,840
1900.....257,667	1922.....760,766

Tasmania.—The first cattle brought to Tasmania were 146 head, part of a consignment from India by the *Lady Barlow* which King sent to Collins in the spring of 1804. In the autumn

of 1805 a similar consignment was landed from the *Sydney* at Port Dalrymple, and a little later Paterson reported that the crossing of Bengal cows with English bulls gave satisfactory results. For many years the island consumed its own cattle, but in 1817 (although at that very time Sorell reported that the government herds were 'at a very low ebb, both as to numbers and quality') cattle were being exported to the Mauritius. While the climate and surroundings seem to have been suitable, farmers took less trouble over their cattle than over any other stock and they were left to depend entirely on the natural pastures. 'So defective' wrote Widowson in 1829, 'is the system of breeding that the proprietors themselves are almost indifferent about them.' In 1841 it was profitable to ship fat cattle to Hobart from Sydney, Twofold Bay, and Corner Inlet—apparently because by that time it had become necessary to provide Tasmanian herds with artificial food, so that the naturally fed Gippsland cattle were cheaper.

Of later developments there is little to say beyond noting the statistics:—

1821.....	35,000	1880.....	127,187
1828.....	84,476	1890.....	162,440
1847.....	72,454	1900.....	165,516
1860.....	83,366	1910.....	201,854
1870.....	101,459	1920.....	208,202
		1922.....	218,197

General.—Within the last 20 years a great improvement has been made in Australian herds, mainly because the industry has come to depend more and more on the export trade, both in frozen and chilled meat and in butter. Temperate Australia—i.e. in practice, the area south of the tropics and east of the 142nd meridian—has the best dairy herds and breeds the best stud cattle; the beef-producing herds, which supply both the Australian demand and the establishments that refrigerate meat for export, run chiefly in the tropical and semi-tropical areas. Queensland produces 48 per cent of the total number, and New South Wales 25 per cent. The value of the industry to the Commonwealth may be gauged by the following figures:—(1922) Number of cattle, 14,336,673, of which 2,419,809 are dairy cows; cattle slaughtered, 1,907,373: (1918-23) beef exported, 697,828,927 lb., value £12,434,537 (nearly 76 per cent went to the United Kingdom. W.S.C.

Cattle-tick, vernacular name of *Boöphilus annulatus* var. *australis,* a species of the family Ixodidae and order Acarina (q.v.). This tick is responsible for two distinct affections of cattle—the mere infestation, which causes sores and anaemia, and the fevers due to certain blood parasites (*Piroplasma* or *Babesia*) of which the tick is a carrier. Not cattle only but horses, deer, asses, and mules—less frequently sheep and goats—are included among its victims. It was probably introduced with Asiatic (Brahma) cattle from Batavia in 1872, but was first noticed through the mortality that occurred in a mob of cattle at Glencoe (104 miles SE. of Port Darwin) in 1880-1. In 1885-6 it was reported between Glencoe and the Katherine River, in 1885-7 on the Roper, and in 1890 on the Macarthur. Through the closing of the boiling-down works at Burketown and Normanton stock traffic was diverted south, and the pest appeared at Hughenden and Longreach about 1895, whence it soon extended to Rockhampton, and reached Brisbane in 1899. Notwithstanding the efforts made to protect New South Wales from infection by a fenced buffer area, the tick was discovered near Tweed Heads in 1906, and at Kyogle on the Richmond River in 1909, but has not established itself in the dry districts of the interior. Thus, while spreading along the stock-routes into Western Australia, and introduced (via Wyndham) to Fremantle, it is reported there as sporadic, probably through climatic conditions.

Life-history.—The mature female tick, detaching herself from her host, falls to the ground and lays from 2000 to 5000 eggs, which are only slightly susceptible to rain or cold, but lose their fertility if unduly exposed to direct sunlight. In

Adult male x 6. Adult female x 2½.
Cattle Tick (*Boöphilus australis*).

warm, moist weather they develop larval ticks in from two to three weeks; these collect in thousands on fences, or vegetation, and readily attach themselves to any object that brushes past. At this stage the six-legged larva is so small as to be invisible to the naked eye. After attachment to its host for about a week it casts its coat, emerges as an eight-legged nymph, matures, and after a second month is fertilized by the wandering male. Then, being half an inch long and distended with blood, the female tick drops off, and the cycle is repeated. The parasitic stage was found by Tidswell to average about 21 days.

Apart from causing tick fever, the presence of a few ticks causes little inconvenience; but a number of them on one animal produce irritation, 'tick worry,' and anaemia, thus causing intense suffering and a high rate of mortality. The parts attacked—the escutcheon, scrotum, and flanks—become inflamed and fissured; ulcerated sores, which become fly-blown, ensue, and the animals grow listless and cease feeding. Horses, if affected, rub themselves violently, bite affected parts until they bleed and lose condition.

Tick fever belongs to a class of diseases due to a minute protozoan blood-parasite; the special Australian form is *Babesia bigemina* which also causes Texas fever in America, and similar diseases in Europe, Asia, and Africa. By the name 'red-water' it was well known in the northern districts of Australia. As, however, haemoglobinuria (red urine) is a symptom common to several affections, this synonym may be misleading, since it is not constant, and many animals die from acute fever without displaying it. Tick fever can be reproduced by inoculation, but it is highly improbable that it is spread by means other than the cattle-tick. Young cattle and calves seem proof against it, but adult cattle, especially bulls, are prone to it in its most acute form. The mortality is greatest in dry weather, and least when animals are well-fed, sheltered, and watered. In some cases 90 per cent of a herd have died; and official stock-returns show a decrease in Queensland from 7 millions in 1894 to 4 millions in 1900, of which 60 per cent is probably due to tick fever. This fever also affects milk production, and many dairy farmers have been ruined by its ravages.

So far, with the exception of a few minor outbreaks in the Tweed River district, no cattle have been known to acquire tick fever

naturally in New South Wales. In Queensland inoculation with the blood of a beast containing *Piroplasma* has been almost exclusively adopted as a protection from further attacks. An inoculated beast, however, acts as a reservoir of infection, as infesting ticks extract the *Piroplasma* and thus spread the disease, which is transmitted through the egg from an infected female to the larval tick. Non-infected ticks only become infected when they feed upon an animal that has the fever; consequently ticks developing on cattle that have not suffered from the fever are incapable of spreading infection. In New South Wales, therefore, inoculation is specifically forbidden.

Of the various devices for eradicating ticks—which are fully described and discussed in *Bulletin No. 13* of the Commonwealth Institute of Science and Industry—dipping at short and regular intervals seems the most effective and expeditious. But, in spite of the results shown to follow this method in the United States, farmers in the northern coastal districts of New South Wales —where the danger of transmission from the infected herds of Queensland is greatest —still oppose the compulsory dipping regulations, and even advocate the abolition of tick-quarantine and the substitution of repeated inoculations. In 1924 it was decided that the governments of the Commonwealth, New South Wales, and Queensland should take joint action to eradicate the tick, New South Wales contributing £91,000 towards the cost, Queensland £25,000, and the Commonwealth £58,000.

Caustic Vine. See ASCLEPIADACEAE.

Caustic Weed. See EUPHORBIA.

Cedar, a name belonging properly to trees of the genus *Cedrus*, and in Australia applied to the genus *Cedrela*, but also loosely used for trees of quite different families that happen to have a timber of similar quality. The white and red cedar, both of the family Meliaceae, are dealt with in separate articles; the bastard pencil cedar, belonging to the same family, is a *Dysoxylon*. For black pencil cedar see ARALIACEAE; for brown cedar, BORAGINEAE; for pencil cedar, PHYLLANTHUS.

Cedar, Red, a genus of the family Meliaceae. *Cedrela toona*, the only indigenous species of the genus (which is widely dispersed over tropical Asia and America), is the red cedar of the eastern States, so much prized for its valuable timber. It is a lofty tree, reaching a height of 150 feet, with large sprays of flowers, dry capsular fruits, and flattened winged seeds. It yields a small quantity of a pale amber-coloured, transparent gum. In India the leaves are regarded as valuable fodder for cattle. The bark is astringent, has been found a valuable remedy in fevers and dysentery, and is considered a fair substitute for cinchona. Leather cured with the bark has a purplish colour. The flowers, called 'toon' in India, yield a rich dye. The tree was in the early days very common in the Illawarra district, but it is rapidly disappearing, except in the less accessible mountain gullies of New South Wales and Queensland. See FORESTRY.

Red Cedar.

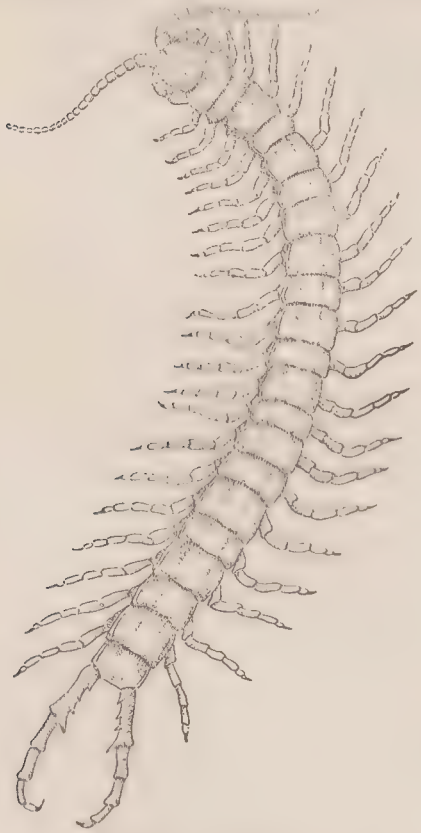
Cedar, White, a genus of the family Meliaceae. *Melia Azedarach*, the only indigenous member of the genus, is a highly ornamental tree, bearing a profusion of lilac-coloured flowers and whitish pulpy berries, much cultivated in parks and gardens as a shade-tree. It grows in coastal brush forests from the northern rivers of New South Wales to northern Australia, and extends to India. The berries are suspected to be poisonous. The Hindus use flowers, leaves and bark for medicinal purposes. The root bark is on the secondary list of the United States Pharmacopoeia an as anthelmintic. In large doses it is said to produce narcotic effects. The tree yields a gum like wattle-gum, which may be collected in considerable quantities. The timber is soft and easily worked. The rings in New South Wales specimens are very marked, and give the timber a rich, wavy appearance.

Celmisia, a genus of the family Compositae, consisting of perennial alpine or sub-alpine herbs, usually with a silvery vestiture, known as 'mountain daisies.' It is chiefly represented in New Zealand; it extends to Antarctica, and in Australia is found in masses on the Australian Alps above the 5000-ft. level. The marginal florets

are rayed; floral bracts in several rows; seeds slightly compressed, with 2-3 prominent nerves on either side; pappus bristles slender, unequal. *C. longifolia*, an eastern species with a densely tufted rootstock of long, narrow leaves, frequently forms large silvery patches in the mountain bogs of Mount Kosciusko.

Centipeda, a small genus of the family Compositae, chiefly Asiatic, consisting of low herbs. The floral bracts are in two rows, leaf-like, with scarious edges; marginal flowers rayless; seeds thick, 4-angled, usually hairy; pappus obsolete. *C. orbicularis* (Sneezeweed) is a small annual, usually found in wet places. It possesses remarkable sternutatory properties, and has been recommended as a substitute for snuff. An infusion of the plant is said to be effcacious in simple ophthalmis inflammation.

Centipedes, vernacular name of a class of arthropods (Chilopoda) which was formerly associated with the millipedes (Diplopoda) in the obsolete class Myriapoda, but has now been separated as distinctly from the millipedes on the one hand as from the insects on the other; the chief distinction consists in the position of the generative orifice, which in centipedes is at the posterior, in millipedes near the anterior,



Scolopendra morsitans.

end of the body. Further, centipedes are usually carnivorous, millipedes usually vegetarian.

The largest centipedes belong to the family Scolopendridae (popularly known as 'galley-worms'), and include a number of flat, elongated species with 21 or 23 pairs of legs; the first pair act as poison jaws, and are capable of inflicting an unpleasant, if not dangerous, bite. The terminal claws are more or less poisonous, and leave a track of inflammation if the animal is allowed to crawl over one's naked skin. *Scolopendra morsitans* is common throughout Australia, and almost cosmopolitan in range. *S. gigantea* is eight inches long. *Ethmostigmus rubripes*, the largest of our centipedes, is found also in the South Sea islands. The family Lethobiidae, with several genera, has only 15 segments. The Notophilidae are narrow, elongated centipedes, probably introduced. A familiar if unwelcome visitor to our dwellings is the single Australian species (*Allothereua maculata*) of the family Scutigeridae, variously known as 'Daddy Longlegs' and 'Hairy Nanny.' Of nocturnal habits but harmless, it feeds on flies and other insects; the writer has seen one running briskly off with a cockroach bigger than itself. The Scutigeridae are remarkable both for the ease with which they part with their legs when handled, and for their possession of compound eyes.

All centipedes have unusual quickness of movement. They are found under logs and stones, and occasionally in bedding or clothing; some species haunt the seashore, where they are at times partially submerged. Though generally regarded with revulsion, they are of economic importance as destroyers of caterpillars, wireworms and the like. In the Australian Museum at Sydney is a specimen of *S. morsitans*, with a lizard securely grasped. Some species are prettily and even strikingly marked. Nearly 80 species, belonging to 20 genera, are known from Australia.

See Brölemann in *Records of the Australian Museum*, vol. ix (1912-13).

Cephalopoda. See MOLLUSCA.

Ceratodus, a genus of fishes founded by Agassiz in 1838 to include certain fossil fish whose remains—consisting mainly of tooth-plates belonging to both jaws, each with a number of cusps on the outer margin—had been found in Jurassic and Triassic rocks from various parts of Europe. The name (from *keras*, a horn; *odous*, a tooth) was given because these cusps were supposed to resemble the antlers of a deer. Later discoveries showed that the fish belonged to a group called Dipnoi, which was dominant in Palaeozoic times but is now represented by three genera only—*Protopterus* in Africa, *Lepidosiren* in South America, and *Ceratodus* in Australia. Outside Australia very characteristic teeth of the last-mentioned genus have been found in the upper Permian formation of Texas, in the Triassic of South Africa, India, Germany, and Austria, in the Jurassic of Colorado and the Cretaceous of Algeria and Patagonia. In Australia they have been found in the lower Jurassic strata of Cape Patterson (Victoria), in the Cretaceous of Walgett (New South Wales), in post-Pleiocene deposits on the Darling Downs, and in the dry bed of a lake near Wilcannia, which is now only rarely filled with flood waters from the River Darling; here they were associated with remains of terrestrial and fluviatile animals, such as *Diprotodon*, giant kangaroos, turtles, crocodiles, and fish that are either extinct or have withdrawn to moister regions. It is now established that during Jurassic times *Ceratodus* was widely spread over the world, living in Europe side by side with the early ancestors of the marsupials. It survived in Africa and South America until Cretaceous times; then it apparently died out everywhere except in Aus-

tralia—and even here its distribution became extremely limited, owing to climatic changes that have resulted in the desiccation of large areas of the continent.

The existing *Ceratodus* (Lung-fish, Burnett Salmon) is a freshwater fish, now confined to the middle stretches of the Burnett and Mary rivers in Queensland. Until 1870 only the fossil teeth were known, but in that year a living representative of the type to which these clearly belonged was discovered in the Burnett River, and described by Krefft under the name *Ceratodus forsteri*. It had long been known to the settlers under the name of Burnett salmon, because of its red flesh, which is coarse, oily and valueless as food. Still further confusion has been caused by the application to it of the name 'barramundi;' this, strictly speaking, should be confined to a bony fish, *Scleropages leichhardti*, which does not occur in the Burnett, but is widely distributed over the more northern parts of Australia. The native name for the lung-fish on the Burnett River is stated by Semon to be 'djelleh.' In 1871 Günther, and in 1876 Huxley, described the structure of *Ceratodus;* but it was not until 1893, when the first of the large series of monographs dealing with the material collected in Queensland by R. W. Semon was published, that a complete account of its anatomy and development appeared. Meanwhile Castelnau in 1876 had described under the name of *Neoceratodus blanchardi* a new genus and species of fish, which he said came from the Fitzroy River and was very closely allied to *Ceratodus forsteri*. The latter does not occur in the Fitzroy, and the identity of Castelnau's fish is unknown: but his description of its teeth alone proves conclusively that it was quite distinct from the *Ceratodus* of the Burnett and Mary Rivers. His name of *Neoceratodus* has, however, been widely (but wrongly) adopted by many writers for the existing *Ceratodus*, to distinguish it from the fossil forms.

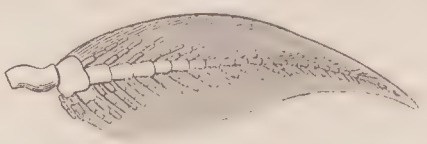
In 1891 Teller, describing the cranium of a species of *Ceratodus* from the Trias of Wurtemberg, pointed out certain differences between the skeletal structure of Mesozoic and recent forms, and suggested the retention of the original name for the former and the adoption of *Epiceratodus* for the latter. Apart from other features, such as the more primitive development of the skeleton in the living form, the number of denticles on the teeth-plates is distinctive. In typical Jurassic and Triassic species it is four in the lower and five (or four and a rudiment of a fifth) in the upper jaw. In Cretaceous forms the number is apparently never below five in each jaw, and may be six; whilst in post-Pliocene and recent forms it is six in both jaws with, in addition, the rudiment of a seventh in the upper. A similar increase in the number of denticles has been noted in certain sharks as they are traced onwards in time.

Adopting Teller's suggestion, the Dipnoans may be divided into two orders:—Ctenodipterini (in which the cranial roof-bones are small and numerous), containing only fossil forms, such as *Dipterus, Phaneropleuron,* and *Ctenodus;* and Sirenoidei (in which the cranial roof-bones are large and few), containing the living genera *Protopterus, Lepidosiren,* and *Epiceratodus* and the extinct genera *Ceratodus* and *Gosfordia*—the latter imperfectly known from the Triassic beds of New South Wales. Two remarkable features of the Dipnoi are (1) the large amount of specialization in the group at a very early geological period, (2) the extraordinary persistence of certain types.

Epiceratodus, then, is represented by only one living species, *E. forsteri* (Krefft). The body is covered with large, overlapping, cycloid scales; the tail is diphycercal, the fin running evenly all round it; the paired limbs are lobate and not fringed as in *Lepidosiren,* nor are there external gills as in *Protopterus.* The mouth is small and narrow, with fleshy lips; the external nares are on the under-side of the snout; the gill-cover has large scales, and the gill-openings descend to below the pectoral paddle, the entrance being covered by a cutaneous fringe. Externally its form is distinctly piscine; but the structure of

Lower Jaw of *Epiceratodus forsteri.*

its internal organs—more especially in regard to the circulatory and respiratory systems—indicate that it may be regarded as in some respects a transitional form, giving us hints of the possible modification of a water- into a land-animal. The mouth has no marginal teeth, but possesses a pair of chisel-shaped vomerine teeth and the very characteristic palatal dental plate in the upper, and splenial plate in the lower jaw. The internal nares open—as in no other fish, but as in amphibia—on the roof of the mouth; the rudiment of a tongue is present, and (as in sharks) the intestine possesses a spiral valve. In regard to the skeleton the skull is autostylic, i.e., the mandible articulates directly with the skull, as in *Chimera;* the notochord is persistent; the cartilaginous cranium is strongly developed and roofed by dermal bones; maxillae and pre-maxillae are absent, and, to carry the upper tooth-plates, the palatopterygoid bones are strongly developed and fuse with the skull in front and behind. The fins are characterized by the pre-



Pectoral Fin of *E. forsteri.*

sence of a median axis with paired radials, forming an archipterygium, as in the extinct Devonian Dipnoan fish *Dipterus.* The respiratory and circulatory systems reveal structures annectent on the one hand with sharks and on the other with amphibians. The gill-clefts are five in number, each of the four branchial arches bearing a complete double row of highly developed lamellae; this indicates the functional importance of the gills. The air-sac, or swim-bladder, arises from the under-side of the oesophagus and, passing immediately round the right side, runs backwards above the alimentary canal. In *Protopterus* and *Lepidosiren* it is completely double; in *Epiceratodus* it is a single sac, but down the central line, both dorsally and ventrally, there is a smooth, broad band of connective tissue separating two

lateral series of 'air cells,' the walls of which are strongly sacculated to afford a wide area for the distribution of the pulmonary veins and arteries. In *Protopterus* the structure of this organ is more highly developed than in *Epiceratodus*, and there can be no doubt that the lung of air-breathing vertebrates is a direct modification of the air-sac or swim-bladder of primitive fishes, in which it served perhaps mainly a hydrostatic and certainly not a respiratory function. The circulatory system shows a remarkable mixture of piscine and amphibian features. The heart is more or less distinctly three-chamber, with two auricles and one ventricle. The afferent arteries to the gills arise, close-set, from a *conus arteriosus* suggestive of those of primitive amphibia. The gill circulation is essentially piscine, except that from the last efferent artery on each side a vessel containing blood that has already passed through the gills on the fourth branchial arch arises and runs back to the lung. Two pulmonary veins, one corresponding to each half of the lung, return the blood into the left half of the auricle. Another striking feature is the presence of a left posterior cardinal vein, just as in fishes, and side by side with this a post-caval vein, as in amphibia. The blood from the tail region is carried forward by the caudal vein, which divides into two branches, each of which receives veins from the kidney. One of these passes on as the left posterior cardinal; the other runs along the lower side of the right testis, and then passes to the middle line and enters the *sinus venosus*, having the same relation to the liver and hepatic veins as the post-caval of amphibia.

In regard to their habits the Dipnoi vary much. *Protopterus* and *Lepidosiren* bury themselves during dry seasnos in burrows in the mud, leaving an opening at the end for breathing through. *Epiceratodus* never leaves the water. It is quite incapable of movement on land, and spends its time either lying on the bed of the stream or moving about sluggishly, day and night alike, in search of its mixed diet—seeds and fruits of gum and tea-tree and water-plants, with small crustaceans and molluscs that live amongst the latter. During the rainy season the Burnett flows between deep banks with, in flood-time, a depth of 30 to 40 feet; but during dry seasons it may be reduced to a series of disconnected water-pools, foul with decomposing animal and vegetable matter. It is under these conditions that the lung is of special use.

The opercular cavity is filled and emptied about 12 times every minute; and at all seasons the fish comes periodically to the surface every 30 or 40 minutes, projects the tip of its snout, and empties and refills its lung, at the same time making a slight groaning noise. When the water is putrid, this power of breathing enables *Epiceratodus* to remain alive and active when all other fish in the same pool perish.

Spawning takes place principally in September and October; each egg is deposited separately amongst (but not attached to) vegetation, and surrounded, like those of a frog, with a coating of jelly. These eggs, which finally lie on the mud, are extremely fragile, and very sensitive to changes in the temperature or purity of the water. The early stages show a general resemblance to those of amphibia, but there is no larval metamorphosis; the tail is diphycercal from the first; the limbs always have the archipterygial form, the pectoral appearing at the third and the pelvic not until the tenth week. At nine weeks old the young are one inch long; at seven months, two inches. It is calculated that a 30-inch specimen is 20 years old and—as the growth-rate lessens in later years—exceptionally large specimens, which may measure six feet, must be of great age. See Plate xii. W.B.S.

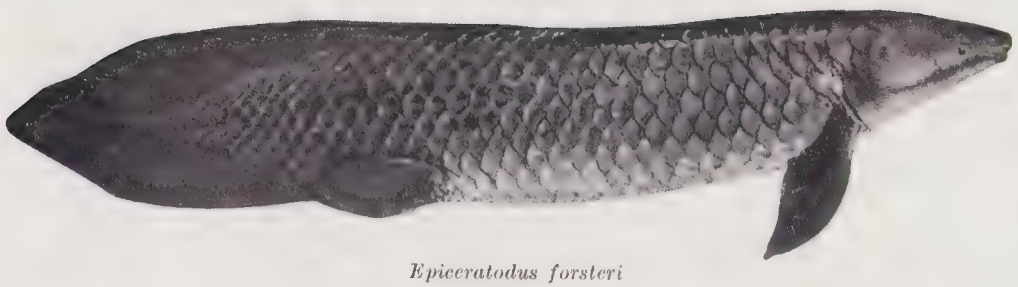
Ceratopetalum, a genus of the family Cunoniaceae, consisting of trees or shrubs; its three species are endemic in eastern Australia. The calyx-lobes are 5, persistent; petals small or none; stamens 10, the small anthers with a recurved appendage; styles united at the base; fruit small, hard, dry, surrounded at the base by the wing-like calyx-lobes; seeds solitary. The genus includes the Christmas bush and coachwood of New South Wales.

Cerbera, a small genus of the family Apocynaceae, dispersed over tropical Asia and Malaysia. *C. odollam,* the only Australian representative of the genus (which extends from Queensland to northern Australia, in all cases on the coast) is a tall bush with thick soft branches; flowers white to yellow, in dense clusters, sweetly scented; fruit large, with a slightly succulent outer and a woody inner coat. Its habitat being coastal, frequently on the edge of tidal waters, the large fruits are specially adapted for prolonged life in the water. The kernel contains a narcotic poison, and the bark is purgative. In Java the leaves are used as a substitute for senna. In India an oil used for burning is extracted from the seeds.

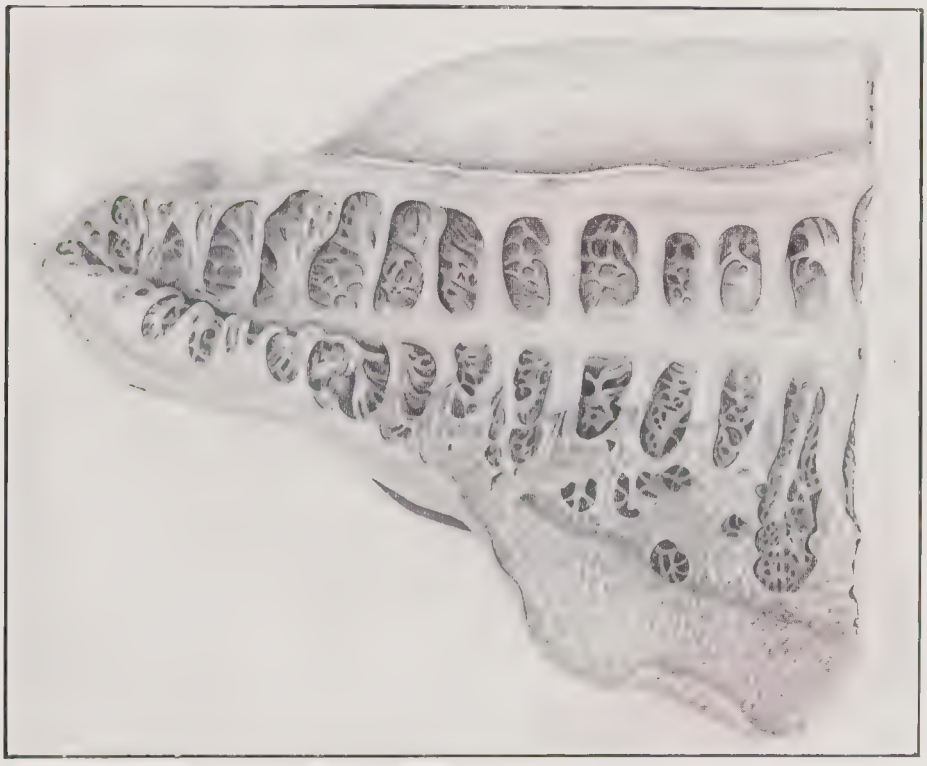
Cerretti, Bonaventure, born at Orvieto in Italy in 1872 and educated at the pontifical seminary in Rome, was ordained priest in 1895, held the chair of classics at the seminary from 1898 to 1900, and in 1901 was attached to the papal secretariate of state. In 1904 he was sent to Mexico as secretary to the apostolic delegate there, in 1906 was made *Uditore* to the apostolic delegation at Washington, and on 19 July 1914 was consecrated archbishop of Corinth and made first apostolic delegate to Australasia. His capable administration of this office led to his recall in 1917 to be appointed secretary of the congregation for extraordinary affairs, in which capacity he was entrusted in 1919 with negotiations with the victorious allied powers regarding Catholic missions in the colonies formerly German. His success, and the general esteem it brought him, led to a further commission in June 1921, when at the resumption of official communications between the Vatican and the French government he was made papal nuncio at Paris. E.M.O'B.

Chafers. See Beetles.

Chaffey, George, a Canadian irrigation expert who, with his brother William, during the seventies and early eighties of last century directed various irrigation enterprises in California. There Alfred Deakin, travelling as a royal commission on water-supply, met them in 1883, and induced them to consider Australia as another field for irrigation. An agent was at once sent to Victoria to prospect the country, and in 1884 George Chaffey came over, selected Mildura on the Murray (just above the junction of the Darling) as a suitable spot, and after some bargaining entered into an agreement with the Victorian government for the gradual settlement of 250,000 acres to be fed by water withdrawn from the Murray. His brother joined him in 1886. The progress of this settlement is narrated under Irrigation. At first the nominally



Epiceratodus forsteri



Lung of *Epiceratodus forsteri*

Chocolate Bat (Bag-tailed)

controlling body, the Mildura Irrigation Company, was itself controlled by the Chaffeys; as settlement proceeded, it was handed over to the settlers, who have ever since controlled their own destinies through an elective body known as the Mildura Irrigation Trust. William B. Chaffey still (1925) grows fruit in Mildura. George Chaffey afterwards became identified with large banking interests in California, as well as with the Imperial Valley irrigation project in the United States.

Challis, JOHN HENRY (1809-1880), son of a military officer, was born in England in 1809, but migrated to Sydney in 1829 and was employed as a clerk by Marsden and Flower, general merchants. In 1842, the firm having been reorganized after Marsden's death, Challis was taken in as a partner 'on his merits, and it is believed without capital' says H. E. Barff in his *Short Historical Account of the University of Sydney*. The new firm—Flower, Salting & Co.—became extremely wealthy when the gold discoveries expanded Australian commerce, and in 1855 was dissolved, the partners retiring on their acquired wealth, which in Challis's case amounted to more than £100,000. This included not only personal property and shares, but a large block of land along the shore of Woolloomooloo Bay, extending eastwards to Macleay-street. After retiring, Challis lived almost wholly in England (except for a short visit to New South Wales in 1859), and took little interest in public affairs apart from education. In the university of Sydney, however, he was always interested; in 1856 he gave a stained-glass window for the great hall, and at his death left by will to the university the whole of his residuary estate, subject to the widow's life interest and a five-year period of accumulation after her death. He died in France on 28 February 1880, and his widow in 1884; in 1890, therefore, the university funds were increased by about £200,000, a sum which was increased in 1905—when the last of certain annuities fell in—by nearly £80,000. From this bequest funds were provided for seven new professorships and four law lectureships. See UNIVERSITIES.

Chalmers, JAMES (1841-1901), born at Ardrishaig in Argyllshire on 4 August 1841, leaving school entered a lawyer's office in Inverary, but when 15 years old determined to be a missionary and in 1861 joined the Glasgow City Mission. Acting on the advice of Dr. Turner of Samoa, he offered his services to the London Missionary Society and entered Cheshunt College in 1862 to take up special studies. On leaving Cheshunt in June 1864 he spent a year in a students' home, and then began the study of Raratongan with George Gill. Ordained to the Congregationalist ministry in October 1865, he in January 1866 sailed in the second *John Williams* for Raratonga, arriving on 20 May 1867 after a voyage full of mishaps, the last stage of which was made in a brig of 150 tons, commanded by 'Bully' Hayes. In the islands he was always known as 'Tamate' —the native version of 'Chalmers.' While at Raratonga he started a monthly newspaper, and waged relentless war against drunkenness; but he desired closer contact with unconverted heathendom, and in May 1877 was transferred to New Guinea. Here during his first exploratory trip (1878) he visited over 100 villages, hardly any of which had previously seen a white man, and moved unarmed and fearless amongst the most ferocious cannibals. His missionary work for the next seven years involved a great deal of detailed exploration which proved politically and commercially valuable; he thoroughly examined the northern bight of the Gulf of Papua, and in 1879 discovered the Purari delta. Before he left the island in 1886 he had planted a series of mission stations along the Gulf from its head eastwards to the Louisiades. He did not approve of the premature annexation of Papua in 1883 by the Queensland government; but when in 1884 the British government decided to establish a protectorate over south-eastern New Guinea, Commodore Erskine and Vice-admiral Bridge warmly acknowledged the help given them by Chalmers and his fellow-missionary Lawes, and recommended that they receive some recognition; the recommendation was ignored. In 1886 Chalmers visited England, where to his surprise he was lionized and sought after as a missionary deputation. On his return to Papua he spent several years in visiting stations, but in 1892 settled at Motumotu, west of Port Moresby, intending to explore parts of the country still unknown; thus he went up the Fly River as far as Howling Point, and blazed tracks into many savage districts. In 1894-5 he revisited England for the Centenary of the London Missionary Society, and was presented with the freedom of the ancient royal burgh of Inverary. On 4 April 1901 he left Daru Island for a trip to Godaribari Island, west of the Aird delta. The natives crowded the *Niue*, and Chalmers, to get them away, arranged to go ashore next morning. In the morning, therefore, he and a fellow-missionary entered the long house, where they were attacked from behind with stone clubs, their heads were cut off, their bodies hewn in pieces, and eaten the same day. The massacre was prearranged. In a letter to his mother Stevenson described Chalmers (who had visited him at Samoa in 1890) as a 'man nobody can see and not love. He has plenty of faults like the rest of us; but he's as big as a church.' His writings comprise *Work and Adventure in New Guinea* (1885) written in collaboration with W. W. Gill, *Pioneering in New Guinea* (1887), and *Pioneer Life and Work in New Guinea* (1895). After his death his friend Lovett published his *Autobiography and Letters* (1902) and a biography *Tamate* (1904). J.C.

Chamaelaucium, a genus of the family Myrtaceae, endemic in Western Australia. The calyx-tube is bell-shaped, 10-ribbed, 5-lobed, the lobes usually petal-like; petals 5, orbicular; stamens 10, shortly united in a single row; fruit formed of the hardened base of the persistent calyx. *C. uncinatum* (Geraldtown Wax Flower), a shrub with large pink and white flowers, is very adaptable, easily cultivated from the seeds and highly ornamental.

Chambers, CHARLES HADDON (1860-1921), born at Stanmore near Sydney on 22 April 1860, educated at Fort-street school and appointed to the public service at the age of 15, soon abandoned it for insurance canvassing, station life, and travel overseas. For a short time he managed the Montagu-Turner opera company, but in 1882 settled in London as a free-lance journalist and playwright. In 1888 his play 'Captain Swift' was a London success, and 'The Idler' (1890), 'John-a-Dreams' (1894), and 'The Tyranny of Tears' (1899) established him as a sound and competent dramatist. During the war of 1914-18 he was employed on propaganda work, and made ten visits to the United States; his comedy 'The Saving Grace' was written with this work in view. He never revisited Aus-

tralia, but to the end of his life dreamt of doing so, and considered himself an Australian. He died on 27 March 1921.

Champ, William Thomas Napier (1808-1892), born at Maldon in Essex on 15 April 1808 and educated at the Royal Military College, Sandhurst, entered the army on 16 November 1826 as ensign, and in October 1828 reached Sydney with a detachment of his regiment, the 63rd. In 1829 the detachment was shifted to Tasmania, where the rest of the regiment joined it. He served for a time at Macquarie Harbour, and in 1830 took part in Arthur's attempt to 'drive' the natives down to East Bay Neck. In 1832 Champ, then stationed at New Norfolk, was commissioned lieutenant in the 39th regiment, but remained attached to the 63rd; and, when that regiment left the colony in January 1834, he went with it to the Mauritius. In 1837 he returned to settle at New Norfolk, where he became assistant magistrate, then chairman of a board appointed to investigate affairs at Port Arthur, and finally an efficient and humane comptroller-general of convicts—a position from which he retired in 1848. When in November 1851 H. S. Chapman (q.v.) resigned his position as colonial secretary under Denison because he disagreed with the official pro-transportation policy, Champ was his successor; in November 1856, when responsible government was conferred on the colony, he (having been elected one of the members for Launceston) became the first Tasmanian premier, and at the same time was given £6000 as compensation for loss of the permanent office. After four months in office he was defeated on a vote to reduce the governor's salary, abandoned politics (for which he had no taste), and settled in Melbourne, where in July 1857 he succeeded John Price (q.v.) as inspector of prisons and head of the penal department. The reforms he introduced, while not specially scientific, did away with many notorious abuses, and greatly improved both the effectiveness and the rationality of the system. He held the post until 31 December 1868, and then retired on a pension. During these years he joined the local defence forces as lieutenant-colonel, retiring as colonel. In 1871 he re-entered politics as member of the assembly for the East Bourke Boroughs, but resigned his seat after two sessions. He died in Melbourne on 25 August 1892.

Channelbill. See Cuckoos.

Chapman, Henry Samuel (1803-1881), born at Kennington in Surrey on 21 July 1803 and educated at Bromley in Kent, in 1823 migrated to Canada, where he founded and edited the first Canadian daily newspaper, the Montreal *Daily Advertiser*. Returning to England at the end of 1834, as a delegate from Canadian reformers who wished to obtain representative government for their colony, he joined the Wakefield-Buller group of politicians, and established friendships with Cobden and John Stuart Mill; he expounded publicly the Wakefield principles of colonization with special reference to New Zealand, was called to the bar in 1840 to become advocate to the New Zealand Company, wrote the article on New Zealand in the seventh edition of the *Encyclopaedia Britannica*, and in 1843 migrated to New Zealand on appointment as judge of the supreme court there. On 29 July 1851 he was made colonial secretary of Tasmania, but quarrelled with the governor over the transportation question (he himself being an anti-transportationist) and resigned his post in November of the same year. During a subsequent visit to England he refused a West Indian governorship. Returning to Hobart, he in November 1854 left that town for Melbourne, where he was admitted to the Victorian bar and came into notice for his share in defending the Eureka Stockade rioters; in February 1855 he was elected to the old legislative council, and in 1856 to the new assembly, where he identified himself with the Duffy-O'Shanassy group, and was O'Shanassy's attorney-general in the ministries of 1857 and 1858-9—the second of which he formed. In O'Shanassy's third ministry (1861-3) he had no place, but towards the end of its course was made acting judge in equity during the absence of Sir Redmond Barry. During his stay in Victoria he also for some time acted as lecturer in law at the local university. In 1864 he returned to New Zealand, again as judge of the supreme court for the province of Otago; this position he held until 1875, when he retired on a pension and busied himself with educational affairs, being towards the end of his life chancellor of the university of Otago. He died in Dunedin on 27 December 1881.

Chapman's particular gift to Australia was the Australian ballot (see Ballot, Voting by). When late in 1855 William Nicholson brought in a resolution in favour of election by secret ballot, Chapman voted in favour of it, and proceeded to draft the clauses defining the method of applying it. These clauses are given in full in the *Victorian Historical Magazine* (vol. viii, pp. 54-5); apart from the provisions for secrecy their essence is that the voter strikes out the names of all candidates for whom he does not wish to vote. Though introduced by Nicholson, they are certainly the work of Chapman; and to him is due the credit of inventing a workable scheme of voting, which has since been adopted in most parts of the English-speaking world.

Chats. This name is applied in Australia to an endemic family (Ephthianuridae) of small perching birds, quite unconnected with the chats (Saxicolidae) of Europe and Africa. They are attractive little birds, mostly ornamented with bright colours, and often met with in small parties—chiefly in open country with scattered bushes. Their nests are cup-shaped, composed of grass and lined with hair, and placed in a low bush or tuft of grass. When nesting, they display great anxiety if an intruder approaches, and in their endeavours to attract him away from the locality they pretend to be wounded, fluttering along the ground and uttering notes of distress. This habit—well known among ducks and plovers—is very rarely displayed by perching birds other than the Australian chats.

In all the species the sexes differ considerably in plumage, the male being more brightly coloured. The commonest throughout southern Australia is the White-fronted Chat (*Ephthianura albifrons*), known by a number of local names, the commonest of which are probably 'nun' (from the white head of the male) and 'tang,' an imitation of the note. The plumage in this species is white, black, and grey. The Crimson-breasted Chat (*E. tricolor*) is distinguished by the feature from which it gets its name. It occurs throughout Australia, but in the south is much less common than the former species. The other members of the family are confined to almost entirely the inland districts, the Orange Chat (*E. aurifrons*) occurring in

CHATS

Plate XIII

Drawn by Neville W. Cayley.

Bacon Lith. Engr.

1. Yellow-breasted Chat (*Ephthianura crocea*).
2. Orange Chat (*E. aurifrons*), female.
3. Ditto, male
4. Crimson-breasted Chat (*E. tricolor*), male.
5. White-fronted Chat (*E. albifrons*).
6. Crimson-breasted Chat, female.
7. Gibber-bird (*Ashbyia lovensis*).

the drier parts of the southern States and the Yellow-breasted Chat (*E. crocea*) ranging across the north.

An interesting bird from central Australia, only discovered in 1911 and probably a member of this family, is the Desert Chat or Gibber-bird (*Ashbyia lovensis*), which appears to be confined to the gibber plains in the Lake Eyre basin. It is delicate brown above, with a yellowish breast. W.B.A.

Chauvel, Sir Henry George, born at Tabulam on the Clarence River in New South Wales on 16 April 1865 and educated at the Sydney and Toowoomba grammar schools, in 1886 joined the New South Wales cavalry regiment and (except for a short term with the Queensland police in 1894-5) has followed the military profession ever since (2nd lieutenant, 1886; lieutenant, 1890; captain, 1896; major, 1899; lieutenant-colonel, 1909; colonel, 1913; brigadier-general, 1914; major-general, 1915; lieutenant-general, 1917). In 1896 he was appointed to the Queensland permanent staff, in 1899 went to the South African war as adjutant of the first Queensland contingent, and rose to command a mounted infantry battalion and the 7th Commonwealth light horse. In 1902 he obtained a brevet lieutenant-colonelcy. In 1903 he was made staff officer for the light horse regiments in South Australia; in 1911 he became adjutant-general to the Australian military forces, and in 1914 was sent to the war office as Australian military representative, but had not reached London when the Great War broke out and he was at once appointed to command the 1st light horse brigade. It was mainly his report on the state of the winter training camps on Salisbury plain, brought to Kitchener's notice by Sir George Reid, that procured the decision to train the Australian forces in Egypt.

Chauvel joined the brigade on its arrival in Egypt, trained it there, and took it as a dismounted corps to Gallipoli, where he gained a reputation for shrewd leadership, and on 6 December was given temporary command of the 1st infantry division. After the evacuation he was given his choice of taking this division to France or remaining with the light horse, and without hesitation stayed in Egypt. On 16 March 1916 he took command of the Anzac mounted division, which he led at Romani and throughout the advance into Palestine. At the first battle of Gaza the Imperial mounted division was also put under his command, and on 22 April 1917 (after the second battle of Gaza) he succeeded Sir Philip Chetwode in command of the desert column. In August the column was reorganized as desert mounted corps, of three (afterwards five) divisions, including cavalry from Britain, Australia, India, New Zealand, and France; and Chauvel, as its commander, became the first Australian soldier to reach the rank of lieutenant-general. This corps—the largest body of cavalry employed in modern times under a single commander—he led to victory at Beersheba (31 October 1917) and Megiddo (19-20 September 1918) and into Damascus, then capturing Aleppo (25 October) with the 5th—mainly Indian—division. Of Chauvel's work in this last advance through Palestine H. S. Gullett (*Sinai and Palestine*, p. 782) says:—'Chauvel's work with his three cavalry divisions was the dramatic and dominating feature of the advance; and here again it was the faultless planning, and the rare success of the Australian leader in synchronizing the work of his scattered columns . . . . which dismayed and overwhelmed the enemy.' Returning to Australia in 1919, he was on 10 December made inspector-general of the Australian military forces, and on 11 June 1923 became also chief of staff. (C.M.G., 1900; C.B., 1916; K.C.M.G., 1917; K.C.B., 1918; G.C.M.G., 1919. Also holds the Order of the Nile, 2nd class, and the Croix de Guerre.)

Cheeke, Alfred (1811-1876), born at Evesham in Worcestershire in 1811 and educated privately, became a student at Lincoln's Inn in November 1831 and was admitted to the bar at the Middle Temple on 29 January 1836. In the following year he migrated to Australia, reaching Sydney in October. In November he was admitted to the local bar, in 1838 became a magistrate, and in 1841 was made a commissioner of the court for investigating land claims and crown prosecutor for the county of Cumberland. At the sittings of quarter sessions on 2 January 1844 it was pointed out that the legislative council had on a constitutional point refused to vote the crown prosecutor's salary, and the clerk of the peace for a few days performed his duties; but Cheeke's appointment, having been confirmed by the crown in 1842, could not be superseded, and in the end he resumed his work as prosecutor in the hope that the council would reconsider its decision. In January 1845 he became commissioner of the court of requests and in 1851 chairman of the court of quarter sessions. At the first election under 'responsible' government in 1856 he was induced to stand for the electorate of Cook and Westmoreland, but was defeated by James Martin and never touched politics again. In 1858 he was the first district court judge appointed under the act of 1858; and in June 1865 he was made a puisne judge of the supreme court, the only man ever raised from the district to the supreme court bench. He died while still in active employment on 14 March 1876.

Cheese. See Dairying.

Chelmsford, Viscount. Frederic John Napier Thesiger, 1st viscount, grandson of Lord Derby's lord chancellor (1858-9 and 1866-8) and son of the Lord Chelmsford who fought in the Zulu war of 1879, was born on 12 August 1868, educated at Winchester school and Magdalen College, Oxford (B.A., 1891; M.A., 1894), and called to the bar at the Inner Temple in 1893. From 1900 to 1904 he was a member of the London school board and in 1904-5 of the London county council. In 1905 he succeeded his father as third baron Chelmsford, and was appointed governor of Queensland (1905-9) and later of New South Wales (1909-13), in both States impressing himself on the community as a courageous governor and an able and learned promoter of intellectual and scientific achievement. In 1913 he returned to England, and was chosen during the year an alderman of the London county council; but in 1916 he was recalled to the public service as viceroy of India (where he was at the time serving with his territorial regiment), and in that capacity not only brought India through the grave dangers of the war but initiated reforms (known as the Montagu-Chelmsford scheme) which were intended to make it eventually one of the self-governing Dominions. In 1921 he was succeeded at Delhi by Lord Reading, returned to England, and was created a viscount. In January 1924 he became first lord of the admiralty in the Ramsay Macdonald ministry, the first Labour ministry of

Britain. (K.C.M.G., 1906; G.C.M.G., 1912; P.C., G.M.S.I., G.M.I.E., 1916; G.B.E., 1917.)

Chelonia. See TORTOISES AND TURTLES.

Chenopodiaceae, a very large family of plants spread over the greater part of the globe, but most abundant in saline habitats. Thirteen genera, with 146 species, are indigenous to Australia. The genus *Salicornia* has 9 indigenous species. *S. australis* (Samphire or Glasswort) may be found anywhere along the coast-line in salt-marshes and estuaries, and extends to New Zealand. It is a leafless perennial herb, with succulent, jointed stems; the uppermost joint forms the flower-spike, in which the insignificant flowers are embedded. At maturity this joint falls off with the seeds in situ, and floats away on currents that distribute the seeds on other shores. The genus *Suaeda* has one indigenous species, *S. maritima* (Seablite), with a cosmopolitan range. It is a short-lived plant (biennial), frequently associated with the samphire, and produces a succulent berry. Most of the other genera are discussed under SALTBUSHES.

Chermside, SIR HERBERT CHARLES, born at Wilton near Salisbury on 31 July 1850 and educated at Eton, joined the royal engineers in 1868 (lieutenant, 1870; captain and major, 1882; lieutenant-colonel, 1885; colonel, 1887; major-general, 1898), and from 1877 to 1899 served in various capacities in the Near East. In 1882 he was in the Egyptian expedition, in 1884-5 at Suakin as governor-general of the Red Sea littoral, and from 1886-8 had charge of the Nile frontier of Egypt, commanding the Egyptian troops in the Sarras fight of April 1887. He then became consul in Kurdistan (1888-9), military attaché at Constantinople (1889-96), and British military commissioner in Crete (1896-9); returning to England, he was given charge of the Curragh district, and in 1900 went to South Africa in command of the 14th brigade and, later, of the 3rd division. In 1901 he was made governor of Queensland, but retired in October 1904. (C.M.G., 1880; C.B., 1886; K.C.M.G., 1897; G.C.M.G., 1899.)

Cherry, a name applied to several indigenous trees and shrubs outside the genus *Prunus*. The brush cherry may be a *Eugenia* or a *Trochocarpa;* the Herbert River cherry is an *Antidesma;* the native cherry (q.v.) is an *Exocarpus,* as are several other 'cherries;' the white cherry is a *Schizomeria.*

Cherry-tree Borer. See MOTHS.

Chevalier, NICHOLAS (1828-1902), born on 9 May 1828 in Petrograd—where his father (a Swiss) held an important position in the Czar's household—was trained as an artist in Lausanne and as an architect in Munich, studied lithography under Grunner, and in 1852 exhibited two water-colours at the Royal Academy. He also illustrated Layard's *Nineveh,* and designed the setting for the Kohinoor diamond. He continued his studies in Rome in 1853-4, and in 1855 visited Australia to look after investments of his father's. He was the first cartoonist employed by Melbourne *Punch,* introduced Australia to chromolithography, and took up painting in oils, winning in 1864 with 'The Buffalo Ranges, Victoria' a prize of £200 offered by the trustees of the Melbourne gallery for the best picture painted by a resident artist. In 1867-8 he visited New Zealand, and made a number of sketches which were shown at the Paris exhibition of 1868 and afterwards presented by his widow to the government of New Zealand. In 1868 he returned to England with the Duke of Edinburgh in H.M.S. *Galatea*: he then settled in England, executed many commissions for the royal family (including a picture of the Duke of Edinburgh's wedding), and worked steadily until 1886, when gout and other illnesses incapacitated him. He died in London on 14 March 1902.

Chickoowee. See HONEY-EATERS.

Chickup. See HONEY-EATERS.

Childers, HUGH CULLING EARDLEY (1827-1896), born in London on 25 June 1827, and educated at Cheam school, Wadham College, Oxford, and Trinity College, Cambridge (B.A., 1850; M.A., 1857), migrated to Melbourne immediately after taking his first degree, and in January 1851 was made an inspector of schools. In September of the same year he became secretary to the education department and (curiously enough) immigration agent; in October 1852 he was made auditor-general (which gave him control of the colonial revenues and a seat in the council), and as such carried through the act creating the university of Melbourne, of which he became first vice-chancellor; in December 1853 he was transferred to the collectorship of customs, retaining his seat in the council and becoming a minister of the crown—a position which he retained after the advent of responsible government, being member for Portland and commissioner of trade and customs in the first Haines ministry. He left the ministry in February 1857 to become Victoria's first agent-general. This appointment, however, fell through at the year's end on account of a change of ministry in Victoria; and Childers, after a short visit to Australia to negotiate a railway loan, entered British politics as member for Pontefract (1860-1885). Appointed chairman of a select committee on transportation and member of a royal commission on penal servitude, he soon made his mark in parliament and took minor office under Lord Palmerston (1864-6), while in the Gladstone ministry of 1868 he was first lord of the admiralty (1868-71) and after a short retirement for private reasons chancellor of the duchy of Lancaster (1872-3). In the second Gladstone ministry he was secretary for war (1880-2)—during which period he instituted the territorial system of army reform and abolished flogging—and chancellor of the exchequer (1882-5). Standing as a home ruler, he lost his seat at Pontefract in 1885, but was elected by South Edinburgh in January 1886, and in the brief third Gladstone ministry was home secretary. His health now began to fail; in 1892 he left active politics altogether, and died on 29 January 1896.

Among his other political successes was the conclusion in 1885 of the London convention which settled the finances of Egypt for a generation. He maintained his interest in Australia for many years, was agent-general for Victoria a second time in 1872, and from his appointment in 1857 to membership of a Victorian select committee on the subject remained a firm believer in the necessity of Australian federation.

Childs, JOSEPH. See NORFOLK ISLAND.

Chilopoda. See CENTIPEDES.

China Naval Contingent. On 28 June 1900 Sir William Lyne, then premier of New South Wales, received a cable from the colonial office suggesting that vessels of the Australian squadron should be sent to China to take part in the Boxer war. Lyne agreed, and also offered

for active service a contingent of the naval brigade which had been intended for South Africa; and the *Wallaroo* left Port Jackson on 2 July for China. Meanwhile the government of South Australia offered the *Protector*, with or without a crew, and the Victorian government offered 200 men with field guns. All offers were accepted, and on the 19th it was announced that the Imperial government had requisitioned the Aberdeen liner *Salamis* to carry the naval contingent to China. She was at once taken over by the naval department, fitted up for troops, and left Sydney on 8 August with a contingent comprising 200 men from Victoria under the command of Captain Tickell, R.N., and 260 from New South Wales with Captain Francis Hixson, R.N., in command. The *Protector* was declined with thanks on 30 July, but the admiralty reconsidered its decision, and on 2 August cabled acceptance; Captain Creswell (previously of the South Australian naval forces, but then in Queensland) was appointed commander, and the *Protector* with 96 officers and men left Sydney on 11 August.

On 26 August at Hong Kong Captain Hixson handed over command to Captain Gillespie, R.N. The contingent was inspected at Woosung, and reached Taku on 9 September and Tientsin on the 16th; here Lieutenant Hixson and 50 men were installed in the Lama temple, Lieutenant Roberts and 50 men in the British legation, and the remainder at headquarters in the Tartar city. On the 24th Captain Gillespie and a detachment of 300 men were placed under General Lorne Campbell for an attack on the Pehtang forts, but the work had been done by the Germans before the rest of the allied force came up.

Australian naval police effected striking improvement in Tientsin streets, and were complimented on their success. On 10 October the New South Wales contingent was sent to Peking, where they stayed for the winter. About 12 January a small party under Lieutenant Spain went to Kao-li-ying (a Boxer centre) to collect a fine, and destroyed a Boxer temple. The Victorian contingent remained at Tientsin, where their police work proved so valuable that permission was asked to retain them longer. A detachment joined General Ballond's expedition to Pao-ting-fu. The whole contingent received commendation on all hands for smart, soldierly bearing and invariable good conduct. The contingent returned to Australia by the transport *Chingtu*, which left Tientsin at the end of March and arrived at Sydney on 25 April 1901. The *Protector* was employed almost entirely in the Gulf of Pechili, carrying despatches and doing survey work. She left Hong Kong on 24 November, and reached Adelaide on 8 January, when the crew was paid off.

Chinese in Australia. See IMMIGRATION RESTRICTION.

Chionanthus, a small genus of the family Oleaceae, dispersed over warm regions. Three species are indigenous to eastern Australia. *C. ramiflora* extends throughout Malaysia. Its fruit is the principal food of the jagged-tailed bowerbird. It has a dark grey mottled timber, hard and tough, yet easily worked. *C. picrophloia* is confined to Queensland, where it is known as 'Bitter-bark' (the bitter-bark of New South Wales is an *Alstonia*) and to the aborigines as 'eurpa;' its bark is intensely bitter and has been used as a febrifuge. Fabrics have been dyed with an extract from the bark in various tints of brownish-yellow.

Chip-chip. See DIAMOND-BIRDS OR PARDALOTES.

Chisholm, CAROLINE (1808-1877), born at Wootton in Northamptonshire in May 1808, was the daughter of William Jones, a well-known farmer-philanthropist of the time. In 1830 she married Archibald Chisholm, a lieutenant in the forces of the East India Company, settled with him at Madras in 1832, and with his active co-operation established there a 'school of industry' for the children of soldiers which gave them a domestic as well as a general education. In 1838 Chisholm (who had been promoted captain in 1833) obtained sick leave, and with his wife visited Hobart and Sydney, settling at Windsor in New South Wales. When her husband in 1840 was recalled to India, Mrs. Chisholm devoted herself to assisting and befriending the many young female immigrants who were at the time being 'dumped' on the shores of Port Jackson without guidance or supervision. In 1841 she appealed to Lady Gipps, and persuaded Sir G. Gipps to give her a government building for an immigrants' home; there she resided, leaving her family at Windsor, and from the home personally took parties of girls to branch homes at Campbelltown, Maitland, Liverpool, Parramatta, and Port Macquarie, settling them by degrees as servants with farmers and squatters in the various districts. The need for her work may be gauged from the facts that the first 64 girls she received into the Sydney home had 14s. 1½d. between them, and that in six years she was the means of settling 11,000 persons. On one occasion she went 300 miles inland to settle a family; on another she took 147 girls in a batch, and picked up others on her way to the west. To the home she added a registry office so efficient that only ten of the thousands of agreements made in it were ever disputed, and all ten disputes were settled. Among other activities she persuaded Robert Towns to give her 4000 acres at Shellharbour and five months' rations for the settlers she might place there; the experiment was entirely successful.

At the end of 1845 Captain Chisholm returned to Australia, and after reviewing his wife's efforts decided that, a sound organization having been established in New South Wales, immigrants could best be dealt with at the British end. In order, therefore, (*a*) to found a system of 'national colonization' and (*b*) to procure the assisted migration of families whose heads were already in Australia, the Chisholms decided to settle in England, and sailed from Sydney on 14 April 1846. Immediately on arrival in London Mrs. Chisholm opened an information office for intending migrants, founded a 'Family Colonization Loan Society,' and by sheer importunacy forced the emigration commissioners to take up the reunion of separated families. In April 1847 she gave evidence before a committee of the house of lords on the treatment of convicts. The Loan Society, however, was the most important of her creations; it was designed to encourage the migration of whole families at a time by supplementing their scanty funds so as to pay for all their passages, and incidentally effected great improvement in the conditions under which migrants voyaged. Rather than submit to the carelessness and uncleanliness of the usual shipping agents of that time, the society chartered and fitted up a model vessel, the *Slains Castle*, which in September 1850 took 250 persons to Melbourne. Other vessels followed, the movement prospered and attracted at-

tention in official circles, and in 1852 Stuart Donaldson (q.v.) carried in the New South Wales council a vote of £10,000 towards the funds of the society.

Captain Chisholm returned to Australia in 1851 to carry on the society's work at that end. Its management in London having been undertaken by Lord Shaftesbury, Sidney Herbert, and other men of their calibre, Mrs. Chisholm in 1854 joined her husband, and during 1854-5 persuaded the Victorian government to ameliorate the conditions of travel between Melbourne and the goldfields by erecting a series of rough 'dak-bungalows' along the roads. In 1857 she published in the Melbourne *Herald* a series of letters to immigrants and politicians, but towards the end of the year her health broke down, and she retired to Kyneton. In 1859 she moved to Sydney, where she delivered several lectures on migration and land legislation, but never recovered enough strength to resume her former activity. Suffering under severe strain—physical, domestic and financial—in 1862 she opened a school at Newtown, and in October 1863 removed it to Tempe, but in 1866 went back to England, was granted a civil list pension of £100 a year, and after ten years of quiet retirement died at Walham Green on 25 March 1877. Her husband died on 17 August.

The main sources of information for the more important part of this remarkable woman's life are Aeneas Mackenzie's *Memoirs of Mrs. Caroline Chisholm* (1852), and a shorter but more accurate memoir in David Mackenzie's *Emigrants Guide* (1853). Sidney's *Three Colonies of Australasia*, published in the same year, devotes a chapter to her work in New South Wales, and in Judge Therry's *Reminiscences* (pp. 416-22) there is a eulogistic account of her work, including an interesting sketch of his encounter with her while on one of her inland journeys with girls. Her own pamphlets, *Emigration and Transportation Relatively Considered* (1847), *The A.B.C. of Colonization* (1850), and *Advice to Emigrants* (1853), also throw light on her ideas. Her contemporaries admired her greatly; Michelet called her the saint of Australia, Lowe and Kendall wrote poems to her, Walter Savage Landor exalted her into a rival of Semiramis, and *Punch* dubbed her 'a second Moses, in bonnet and shawl.'

Chiton. See MOLLUSCA.

Chloanthes, a genus of the family Verbenaceae, consisting of perennials, undershrubs or shrubs, more or less cottony, woolly, or clothed with glandular hairs, all endemic in Australia. The calyx is more or less deeply divided into 5 narrow herbaceous lobes; corolla-tube elongated, usually incurved and dilated upwards, the lobes forming two lips; stamens 4, in 2 pairs, inserted below the middle of the tube above a ring of cottony hairs; fruit a dry drupe, separating into 2 hard nuts, each with a solitary seed; leaves opposite or whorled. Two eastern species, *C. glandulosa* and *C. Stoechadis* (with greenish-yellow flowers), are partial to the coastal sandstone.

Clough, White-winged (*Corcorax melanorhampus*), a rather large bird, peculiar to south-eastern Australia, usually placed in the family of crows (Corvidae). The choughs (Fregilinae) constitute a division of this family that frequents mountains and cliffs from the British Isles to northern China, extending southwards to Abyssinia and the Himalayas. If the Australian bird is really related to them, it forms a striking example of discontinuous distribution.

White-winged Chough.

The white-winged chough is a black bird with a scarlet eye, and a patch of white on the middle of the flight-feathers of the wing which is only exposed when the bird flies. It is chiefly found in the inland districts, especially near the rivers of the Murray system, where it runs about on the ground in search of insects, flying up into the trees when disturbed. Like the grey jumper and the babblers it associates in small companies, and on this account is sometimes (but wrongly) called 'apostle-bird' or 'twelve apostles;' in some districts it is also called 'black magpie' or 'mutton-bird.'

The chough builds a basin-like nest of mud, lined with grass, on the horizontal limb of a tree, and lays five to seven eggs, yellowish-white blotched all over with olive and purplish-brown. When perched in a tree it sometimes utters a low, mournful piping; and the male bird, when courting, indulges in curious antics, puffing out his feathers, spreading his wings and tail, and lowering his head.

W.B.A.

Christian, FLETCHER. See 'BOUNTY,' MUTINY OF THE.

Christmas Bells. Several species of the genus *Blandfordia* are known by this popular name, but it is usually given to *B. nobilis*, a species with rigid narrow leaves, and flowers of a wax-like texture, usually found in swampy sandstone country and confined to New South Wales. *Blandfordia*, a genus of the family Liliaceae, contains 4 species, all herbs with a thick rootstock and long tufted leaves. The erect flower-stem, rising from the centre of the tuft, bears at the top a cluster of flaming, pendulous, bell-shaped flowers shading from reddish-brown or orange to yellow. The fruit capsule is narrow, elongated and 3-angled, containing numerous seeds covered with prominent hair-like protuberances. *B. nobilis* has been described above. *B. grandiflora*, also limited to New South Wales, has larger flowers of a deeper red than *B. nobilis*. It grows in peaty pockets on the craggy escarpment of the Blue Mountains, overhanging Leura

and Wentworth Falls. *B. flammea*, with large pale flame-coloured flowers, extends from northern New South Wales to Queensland. *B. marginata*,

Blandfordia nobilis.

the handsomest of all, is limited to Tasmania, and grows even at heights of 4000 feet.

Christmas Bush, a name applied to different plants in different parts of Australia, obviously because their flowering period makes them especially suitable for Christmas decorations. The Christmas Bush of New South Wales is a *Ceratopetalum* (q.v.), *C. gummiferum*, usually a shrub, though when growing in suitable situations it attains a height of 30-40 feet. The flowers are usually in clusters, 3 in a spray; calyx-lobes 5, persistent; leaves, in opposite pairs, divided into three leaflets 1½-3 inches long, toothed round the margin, shining and feather-veined; fruit winged. The small white flowers, which have jagged petals, soon wither; then the calyx, which is at first insignificant, enlarges and turns a terra-cotta red. It is this calyx that gives the plant its highly distinctive character, its branches being widely used in New South Wales for Christmas decoration. If wounded, the shrub exudes a ruby-coloured astringent kino. The timber is fine-grained and reddish-coloured, and is sometimes used for tool-handles, etc. The shrub ranges from the Richmond River to Moruya, and as far west as the Blue Mountains; it lends itself readily to cultivation, and forms a most decorative hedge plant in suburban gardens. The Christmas Bush of Western Australia is a widely different tree, *Nuytsia floribunda* (q.v.), which, although a branching tree with a massive trunk, actually belongs to the Loranthaceae or mistletoe family. The flame-coloured masses of its brilliant orange flowers contrast strongly with the more sombre eucalypts by which it is usually

Christmas Bush.

surrounded, and justify its alternative name of blaze tree.

Chronological Table.

1606 Quiros discovers the New Hebrides. The *Duyfken* in the Gulf of Carpentaria (March). Torres sails through Torres Straits (September).
1616 Dirck Hartog discovers Eendracht Land (Western Australia).
1619 Frederik Houtman discovers western coast from Swan River northwards.
1622 The *Leeuwin* coasts south-western Australia to lat. 35° S.
1623 Jan Carstensz in the Gulf of Carpentaria. Arnhem's Land discovered.
1627 The *Gulden Zeepaert* coasts Nuyts' Land as far as Streaky Bay.
1628 The *Vyanen* runs aground on De Witt's Land.
1629 Pelsart wrecked on the Abrolhos.
1642 Tasman discovers Tasmania and New Zealand.
1644 Tasman's second Australian voyage: Australia coasted from Cape York to Eendracht Land.
1688 Dampier visits north-western Australia in the *Cygnet*, landing at Buccaneer Archipelago.
1696 Willem de Vlamingh discovers Swan River.
1699 Dampier explores north-western coast in the *Roebuck*.
1705 John Harris suggests the occupation of Tasmania.
1756 Charles de Brosses proposes that France should occupy Australasian territory with foundlings, beggars and criminals.

1766 John Callander makes similar suggestion for England.
1768 James Cook in the *Endeavour* sails for the Pacific.
1770 Cook sights the eastern coast, and annexes it under the name 'New South Wales.'
1779 Banks proposes to send convicts to Botany Bay.
1783 Matra proposes to colonize New South Wales with 'loyalists' from America.
1785 Sir George Young proposes to colonize New South Wales with 'loyalists,' Friendly Islanders and Chinese.
1786 Lord Sydney orders the equipment of a fleet to convey convicts to Botany Bay.
1787 'First Fleet' sails (May).
1788 Fleet reaches Botany Bay. Port Jackson examined and settlement made on Sydney Cove. La Pérouse in the *Astrolabe* visits Botany Bay. Norfolk Island settled.
1789 Hawkesbury River explored. Launch of first vessel built in colony. First theatrical performance in Sydney.
1790 First land grant—made to James Ruse at Rose Hill (Parramatta). First detachment of New South Wales Corps reaches Sydney.
1791 Vancouver discovers King George's Sound. Whaling and sealing industry begun. Bowen discovers Jervis Bay. Fort constructed on Dawes Point.
1792 New South Wales Corps in control of the colony. Arrival in Port Jackson of first foreign trading vessel—the *Philadelphia* from the United States.
1793 First free settlers arrive; located at Liberty Plains (Bankstown). First church built by Richard Johnson.
1794 Settlement formed at the Hawkesbury. The 'Scottish Martyrs' arrive.
1795 The Cowpastures discovered. Bass and Flinders explore George's River. First printing press erected in Sydney. Governor Hunter arrives.
1796 Bass and Flinders coast Illawarra. First theatre opened in Sydney. Coal found at Port Stephens.
1797 Coal found at Illawarra. Hunter River discovered, and coal found near its mouth. First merino sheep imported.
1798 Bass discovers Western Port. Bass and Flinders circumnavigate Tasmania.
1799 Flinders surveys coast northwards to Hervey Bay. Coal first exported (to India).
1800 Governor King arrives. Volunteer associations founded at Sydney and Parramatta. Currency regulated.
1801 Coal exported to Cape of Good Hope. Blankets and linen first manufactured in the colony. Flinders in the *Investigator* reaches Cape Leeuwin (December).
1802 Murray discovers Port Phillip (January). Flinders explores Spencer Gulf and St. Vincent Gulf (Feb.-March). Baudin on Australian coast. Flinders on eastern and northern coasts (July onwards).
1803 Bowen settles at Risdon on the Derwent, Tasmania. Collins attempts settlement on Port Phillip. *Sydney Gazette* first issued. Flinders imprisoned in the Mauritius.
1804 Paterson settles on the Tamar, Tasmania. Collins abandons Port Phillip and moves to Hobart. Abortive mutiny of Irish convicts at Castle Hill.
1805 John Macarthur, intent on developing the merino wool industry, obtains grant of 5000 acres at Camden.
1806 Hawkesbury floods. Governor Bligh arrives.
1807 First parcel of merchantable wool exported to England. Norfolk Island settlers removed to Tasmania.
1808 Bligh deposed by New South Wales Corps.
1809 First post-office opened (at Hobart).
1810 Macquarie proclaimed governor. New South Wales Corps recalled to England. First post-office on mainland opened in Sydney, and first free school established there. The *Derwent Star* (first Tasmanian newspaper) issued for a brief period.
1813 Blaxland, Lawson and Wentworth cross the Blue Mountains. Evans crosses main range and discovers Macquarie River. The 'holey dollar' circulated as currency. Evacuation of Norfolk Island completed.
1814 Civil and criminal courts separately established. First supreme court judge arrives. Hume opens up Berrima tableland.
1815 Bathurst founded. Road across the Blue Mountains completed. Lachlan River discovered by Evans. First steam-engine operated in Sydney.
1816 Sydney botanic gardens laid out. *Hobart Town Gazette* first published.
1817 Oxley explores Lachlan River. P. P. King examines north-eastern coast. Bank of New South Wales established.
1818 Meehan discovers Lake Bathurst and Goulburn Plains. Oxley explores the Macquarie, and discovers Liverpool Plains and Port Macquarie.
1819 Commissioner Bigge sent from England to report on the state of the colony. First Australian savings-bank instituted in Sydney (Campbell's Bank). Wentworth's *Statistical, Historical and Political Description of New South Wales* published in London.
1820 Wild discovers Lake George.
1821 Penal settlement established at Port Macquarie. Governor Brisbane arrives.
1822 New South Wales Agricultural Society formed. Bigge's report issued.
1823 McBrien reports discovery of gold in Fish River. Ovens and Currie explore Monaro. Oxley discovers Brisbane River; Cunningham discovers Pandora Pass. Judicature act passed. Dr. Lang arrives.
1824 Legislative council and supreme court established: trial by jury allowed on limited basis. Censorship of the press abolished. *Australian* newspaper issued. Settlement made on Melville Island. Hume and Hovell journey from Yass to Port Phillip.
1825 Moreton Bay opened up, and Norfolk Island reopened, as penal settlements. Tasmania separated from New South Wales. Van Diemen's Land Company granted 250,000 acres in north-west. Sydney chamber of commerce established. Boundary of New South Wales extended to 129° E. long. Cunningham explores Liverpool Plains. Governor Darling arrives.
1826 Settlements made at Western Port and Albany. Australian Agricultural Com-

pany granted a million acres north of Port Stephens. Australian subscription library opened in Sydney.

1827 Cunningham discovers Darling Downs. Settlement made at Raffles Bay in northern Australia. Stirling on Swan River.

1828 Western Port settlement abandoned. Richmond and Clarence River valleys opened up. Cunningham discovers track from coast to Darling Downs. Colonial (afterwards Australian) Museum founded in Sydney.

1829 Sturt discovers Darling River. Settlement made at Swan River. Settlements at Melville Island and Raffles Bay abandoned. Wakefield publishes in London *A Letter from Sydney*.

1830 Sturt discovers Murray River. Penal settlement at Port Macquarie broken up. 'Black war' in Tasmania. Perth founded.

1831 Free land grants abolished. Assisted immigration begun. First Australian steamship (*Surprise*) launched at Sydney. First steamship arrives from England. *Sydney Herald* newspaper issued. Mitchell's first expedition left Sydney. Governor Bourke arrives.

1832 Savings Bank of New South Wales established.

1833 Trial by jury extended to criminal cases. Busby made resident magistrate at Bay of Islands (N.Z.). The brothers Henty establish a whaling station at Portland Bay.

1834 Settlements formed at Twofold Bay and Portland Bay. South Australian Association organized in England. South Australia act passed.

1835 Batman and Fawkner open up Port Phillip.

1836 South Australia founded. Lonsdale made resident magistrate for Port Phillip. Mitchell discovers *Australia Felix*.

1837 Melbourne named. Adelaide founded. *South Australian Register* newspaper issued. House of commons appoints committee on transportation.

1838 George Grey discovers Glenelg River (W. A.). Settlement made at Port Essington. Assignment system restricted on mainland, preliminary to its abolition. Melbourne *Advertiser* first published. Governor Gipps arrives.

1839 New South Wales governor's jurisdiction extended to include New Zealand. New Zealand Company formed. Settlement made on Port Nicholson. Latrobe appointed superintendent at Port Phillip. Stokes discovers Port Darwin, and Eyre Lake Torrens. Strzelecki finds gold near Hartley. Camels first introduced.

1840 Hobson made lieutenant-governor of New Zealand: treaty of Waitangi concluded. Transportation to Australian mainland abolished. McMillan discovers and Strzelecki explores Gippsland. Adelaide incorporated. Perth *Inquirer* first issued. Caroline Chisholm begins her immigration work.

1841 New Zealand separated from New South Wales. Eyre's 'march' round the Bight. Clarke finds gold on Cox's River. Sydney first lit with gas. First savings-banks established at Melbourne and Adelaide.

1842 Imperial act 'for the Government of New South Wales and Van Diemen's Land' passed. Sydney and Melbourne incorporated. South Australia becomes a crown colony. Copper discovered at Kapunda (S.A.). Moreton Bay opened to free settlers.

1843 New South Wales obtains 'representative' government, Moreton Bay and Port Phillip being represented in the Sydney council. Ridley invents the stripper. Financial crisis, during which Bank of Australia fails.

1844 Sturt explores central Australia: Leichhardt starts out for Port Essington. Norfolk Island annexed to Tasmania. Port Phillip district petitions for separation from New South Wales.

1845 Sturt discovers Cooper's Creek. Leichhardt reaches Port Essington. Copper discovered at Burra Burra (S.A.).

1846 Mitchell on the Barcoo River. *Moreton Bay Courier* and Melbourne *Argus* first published. The Chisholms organize the Family Colonization Loan Society in England. Governor Fitzroy arrives.

1847 Kennedy discovers Thomson River (Q.). Leichhardt leaves Moreton Bay on his last expedition. North Australia colony established, and abandoned. Australian Agricultural Co.'s coal monopoly ceases. Overland mail between Sydney and Adelaide organized.

1848 Kennedy murdered at Escape River. Order-in-council abolishing transportation to New South Wales revoked.

1849 Indignant demonstrations in Melbourne and Sydney against revival of transportation. Port Essington abandoned. Great exodus of population to California.

1850 Transportation to Western Australia begun. Last convict ship arrives in Moreton Bay. Anti-transportation League formed in Sydney. Imperial statute 'for the Better Government of the Australian Colonies' passed. University of Sydney founded.

1851 Port Phillip district constituted the colony of Victoria. Governor of New South Wales appointed governor-general of Australia. Gold discovered in New South Wales and Victoria in payable quantities. Australian Anti-transportation League organized. First representative legislatures met in South Australia, Victoria and Tasmania. First telegraph message sent in New South Wales.

1852 Arrival of s.s. *Chusan*, first mail-steamer via Cape of Good Hope.

1853 Transportation to Norfolk Island and Tasmania abolished. Establishment of colonial mints authorized. University of Melbourne and public library of Victoria founded. Sydney corporation dissolved and a commission appointed. Cadell takes first river-steamer 1300 miles up the Murray.

1854 Eureka Stockade. First railway in Australia opened, from Melbourne to Port Melbourne.

1855 Van Diemen's Land renamed Tasmania. Responsible government proclaimed in Tasmania, Victoria and New South Wales. Chinese immigration to Victoria restricted. Sydney mint established.

1856 Government of Norfolk Island vested in New South Wales. Responsible government proclaimed in South Australia. South Australian Institute (with free

public reference library) founded. Voting by ballot introduced in Victoria and South Australia.

1857 Manhood suffrage introduced in Victoria. Sydney corporation reconstituted. Wreck of the *Dunbar*.

1858 Gregory opens up Murchison and Gascoyne districts in Western Australia. Warburton's expedition to Lake Torrens (S.A.). Telegraphic communication established between Adelaide, Melbourne, and Sydney. Manhood suffrage introduced in New South Wales. Copper discovered at Cobar (N.S.W.). Gold discovered at Canoona (Q.). Torrens act passed in South Australia.

1859 Queensland created a separate colony with responsible government. Brisbane incorporated.

1860 McDouall Stuart reaches centre of Australia. Burke and Wills set out for Gulf of Carpentaria.

1861 Title of governor-general abolished. F. Gregory discovers Fortescue, Ashburton, and De Grey Rivers (W.A.). New South Wales territory between 129° and 132° E. long. and south of 26° S. lat. added to South Australia. Anti-Chinese riots at Lambing Flat (N.S.W.). First Melbourne Cup run. Western boundary of Queensland shifted to 138° E. long. Death of Burke and Wills.

1862 J. McKinlay reaches Albert River from Adelaide. McDouall Stuart reaches Chalmers Bay from Adelaide. Kendall's *Poems and Songs* published. First English cricket team visits Australia.

1863 Intercolonial conference held in Sydney. Northern Territory placed under jurisdiction of South Australia. Kanaka labour introduced into Queensland.

1864 First manufacture of sugar (in Queensland). Kanakas employed for sugar cultivation. English salmon ova placed in Plenty River (Tasmania).

1867 Intercolonial conference held, at which Parkes suggests a confederate union. First Victorian protective tariff in operation. Gold discovered at Gympie (Q.). Publication of Gordon's *Sea Spray and Smoke Drift*. Duke of Edinburgh visits Australia.

1868 Transportation to Western Australia discontinued. Kanaka labourers act passed in Queensland.

1869 Electric cable laid between Cape Schanck (Vic.) and Low Head (Tas.). Sydney free public library opened. Kendall's *Leaves from Australian Forests* published.

1870 Intercolonial conference held to discuss intercolonial free trade. British troops withdrawn from Australia. Nominee legislative council of Western Australia dissolved and a partly elective council substituted. Palmerston made capital of Northern Territory. John Forrest leads overland expedition from Western Australia to Adelaide. Gordon's *Bush Ballads* published.

1871 Tin discovered at Mount Bischoff (Tas.). Submarine cable laid between Port Darwin and Banjoewangie (Java). Primary education made compulsory in Western Australia.

1872 Polynesian protection act passed by British parliament. Overland telegraph line from Adelaide to Darwin completed. First through cable message received from England. Melbourne mint opened. Gold discovered at Charters Towers (Q.).

1873 Intercolonial conference favours customs union. Free, compulsory and secular education established in Victoria.

1874 Expedition of J. and A. Forrest from the Murchison to the overland telegraph line. Triennial parliaments act passed in New South Wales. University of Adelaide founded. Clarke's *For the Term of his Natural Life* published in book-form.

1875 Giles leads expedition from overland telegraph line to western coast. Free and compulsory primary education established in Queensland. Compulsory primary education provided for in South Australia. Influx of Chinese to the Palmer goldfield (Q.).

1876 Death of Truganini, last of the Tasmanian aborigines.

1877 Overland telegraph line from Adelaide to Perth completed. Chinese immigration to Queensland restricted. First test match (England-Australia) played in Melbourne.

1878 Seamen strike against coloured labour. 'Black Wednesday' in Victoria. Payment of members act passed in Victoria.

1879 A. Forrest discovers Fitzroy pastoral country (W.A.). First intercolonial trade unions congress held. First artesian bore in Australia sunk in New South Wales. First steam tramway opened in Sydney.

1880 Intercolonial conference in Melbourne. Australian frozen meat first delivered in London. Primary education made compulsory in New South Wales. Art Gallery of New South Wales opened. Kendall's *Songs from the Mountains* published.

1881 Intercolonial conference continued in Sydney. Parkes proposes a federal council. Chinese restriction acts passed in New South Wales, Victoria, and South Australia. First simultaneous census taken in Australia.

1882 Gold discovered at Mount Morgan (Q.).

1883 Queensland annexes south-eastern part of New Guinea. Silver discovered at Broken Hill. Through railway traffic established between Melbourne and Sydney.

1884 British protectorate over south-eastern New Guinea declared. Public library, museum, and art gallery of South Australia established.

1885 Federal council created. Sudan contingent sails. Broken Hill Proprietary Co. commences operations. Silver-lead discovered at Mount Zeehan (Tas.), and gold in the Kimberley district (W.A.).

1886 Federal council first meets.

1887 Colonial conference held in London. First naval defence agreement made. Gold discovered at Yilgarn (W.A.). Public library, museum and art gallery of Western Australia established. First express train runs between Adelaide and Melbourne.

1888 Intercolonial conference considers Chinese immigration; restrictions increased. Australasian Association for the Advancement of Science holds first meeting. Rolf Boldrewood's *Robbery under Arms* published. Tamworth (N.S.W.) lighted with

electricity—first Australian town to adopt this system. Centenary celebrations at Sydney.

1889 Hawkesbury River bridge (N.S.W.) completed. University of Tasmania founded. Lawrence Hargrave discovers principle of rotary engine.

1890 Responsible government established in Western Australia. Maritime strike.

1891 First federal convention drafts federal constitution. Colonies enter Universal Postal Union. First labour party in Australia appears in New South Wales parliament. Free primary education introduced in South Australia.

1892 Rich gold reefs found at Coolgardie (W.A.).

1893 Financial crisis. 'One man one vote' electoral act in force in New South Wales. 'New Australia' party leaves for Paraguay.

1894 Colonial conference meets at Ottawa. Women enfranchised in South Australia. Hargrave makes successful experiments with box-kites.

1895 Intercolonial conference of premiers held. Anglo-Japanese treaty rejected by all the colonies except Queensland. Paterson's *Man from Snowy River* published.

1896 Wages boards established in Victoria. Publication of Lawson's *In the Days when the World was Wide* and *While the Billy Boils*. Brisbane (now Queensland) public library established. Death of Sir H. Parkes.

1897 Colonial conference in London. Second federal convention meets.

1898 Federal constitution bill rejected at referendum in New South Wales. W. J. Farrer appointed official wheat experimentalist. Daley's *At Dawn and Dusk* published. David Scott Mitchell offers his library to the N.S.W. government.

1899 Amended federal constitution bill accepted by New South Wales, Victoria, Queensland, South Australia and Tasmania. Free primary education introduced in Western Australia. Australian troops take part in South African war.

1900 Commonwealth bill passed by Imperial parliament. Western Australia accepts federal constitution. Edmund Barton forms first federal ministry. Australian troops, with gunboat *Protector*, take part in Boxer war (China).

1901 Commonwealth of Australia proclaimed. First federal parliament opened in Melbourne. Inter-State free trade established. White Australia policy embodied in federal acts. Victoria and New South Wales make provision for old age pensions. Industrial arbitration act passed in New South Wales.

1902 Colonial conference in London. Second naval defence agreement made.

1903 Federal high court established. Coolgardie and Kalgoorlie water-supply scheme completed.

1904 First federal labour ministry. Federal conciliation and arbitration act passed. Importation of Kanakas to Queensland discontinued.

1905 Contract immigrants act passed.

1906 Papua taken over by Commonwealth. Primary education made free in New South Wales.

1907 Imperial conference in London.

1908 First *Commonwealth Year Book* issued. Yass-Canberra chosen as site of federal capital. Queensland makes provision for old age pensions. Primary education made free in Tasmania.

1909 Imperial defence conference held in London. Australian defence act, providing for compulsory military training, passed. Visit of Lord Kitchener to advise on Commonwealth military defence. Office of Australian high commissioner in London created. Federal act providing for the payment of old age pensions throughout Australia in operation. First successful aerial flight in a power-driven machine took place. University of Queensland founded.

1910 Referendum on financial relations between Commonwealth and States. Penny postage introduced. First vessels of Royal Australian Navy arrive. Admiral Sir R. Henderson visits Australia to advise on naval defence. First federal bank-notes issued. Visit of Scottish agricultural commissioners.

1911 Imperial conference in London. Temporary committee of Imperial defence formed. Admiral Henderson's naval report. Commonwealth takes over Northern Territory from South Australia. First federal census. University of Western Australia founded. Compulsory military training established.

1912 Commonwealth Bank established.

1913 H.M.A.S. *Australia* arrives. Federal capital city founded and named Canberra.

1914 General Sir Ian Hamilton reports on Australian military defence. Visit of British Association for the Advancement of Science. European war. Australian expeditionary force occupies German New Guinea. H.M.A.S. *Sydney* destroys German warship *Emden*.

1915 Australian troops landed on Gallipoli peninsula (25 April). Broken Hill Proprietary Co.'s steelworks at Newcastle opened.

1916 Australian troops in France. First conscription referendum held.

1917 First Imperial war cabinet formed. Federal national ministry formed. Second conscription referendum held. General strike in New South Wales. Trans-Australian (east-west) railway completed.

1918 Australia House, London, opened.

1919 Australia admitted to League of Nations. Seamen's strike and Broken Hill strike. Commonwealth competition aerial flight, England to Australia, won by Ross and Keith Smith.

1920 Visit of the Prince of Wales.

1921 Imperial conference in London. Australia takes over German New Guinea as a mandatory under League of Nations. Federal government takes over control of immigration machinery in London.

1922 Legislative council of Queensland abolished. Geraldton-Derby (W.A.) and Charleville-Cloncurry (Q.) aerial mail services in operation.

1923 Imperial conference and Imperial economic conference held in London.

1924 Adelaide-Sydney aerial mail service in operation.

Church of England. In 1786 Viscount Sydney, among other arrangements for the welfare of the proposed settlement in New South Wales, provided for the appointment of a chaplain at a salary of £182 10s per annum. After consulting William Wilberforce (who in turn consulted others, including John Newton of Olney and Cowper the poet), he found that a student, one Richard Johnson (q.v.), who was ready to take holy orders, would be willing to accept the position of chaplain at Botany Bay. Johnson was ordained, and on 10 October 1786 commenced his duties by visiting the hulks and making preparation for the voyage; he received his commission on 24 October. The First Fleet, with Johnson in the store-ship *Golden Grove*, reached New South Wales in January 1788, and on 3 February (the second Sunday after landing) the first religious service was held 'under a great tree' in the presence of the troops and convicts, whose behaviour on this occasion was equally regular and attentive. The site of that service must have been somewhere near, if not actually in, the present Macquarie Place. Johnson's first desire was to erect a suitable building wherein to hold his services, and he sought the governor's aid; but, in spite of explicit instructions (issued on 20 August 1789 to Phillip) that 'a particular spot in or as near each town as possible be set apart for the building of a church, and four hundred acres adjacent thereto allotted for the maintenance of a minister, and two hundred for a school-master,' the building of a church was the last thing that seemed to trouble the governor and his officials. It was not till 1793 that the colony had a definite meeting-place for worship. In the meantime Johnson's duties were practically doubled by the founding of another settlement at Rose Hill (Parramatta), and he complained to the governor in writing both about the lack of a church and about the hardship of having to minister at both Sydney and Rose Hill. In September 1791, however, a detachment of the New South Wales Corps arrived and was stationed at Rose Hill, and the regimental chaplain (James Bain) took over most of the duties at this settlement, leaving Johnson to attend to Sydney. Norfolk Island being a part of the new colony, it was the chaplain's duty to make an occasional visit there, but the inconvenience of this arrangement caused Lieutenant-governor King to apply for an assistant to work on the island; John Crowther was appointed, and left England in September 1789 in the ill-fated *Guardian*, which struck an iceberg after leaving the Cape of Good Hope. The passengers reached the Cape in the ship's boats, and Crowther, disheartened by this experience, threw up his appointment and returned to England.

Johnson, finding all complaints futile, now began to build a temporary church on the east side of the Cove, about the corner of Bligh- and Hunter-streets. Begun on 10 June 1793, it was ready for its first service on 25 August. The design was cruciform, the nave being 75 feet long by 15 broad, and the transepts 40 feet by 15 feet; it was built of wattle and dab, and the roof was thatched. It provided seating accommodation for 500 persons and cost in all £67 12s. 11½d., of which £59 18s. 6d. was paid in Spanish dollars and the rest in provisions and spirits. Johnson in a letter to Henry Dundas (dated 3 September 1793) gave full particulars, and asked that the money should be refunded; but it was not till 31 January 1797 that the authorities admitted the justice of his claim. On 19 March 1925 was laid the foundation-stone of a memorial marking the site of this church; it also commemorates the holding of the first service in February 1788, but that service—as has been said—was held under a tree much nearer the Cove.

Crowther having abandoned his duties, it became necessary to find another assistant for Johnson, and Samuel Marsden (q.v.), a student of St. John's College, Cambridge, was offered the position. Marsden at first refused the offer, but changed his mind and accepted it; his commission was dated 1 January 1793, and shortly afterwards he was ordained. Leaving England on 1 July 1793 in the ship *William*, he reached Sydney on 10 March 1794. As there were now three clergymen in the colony, Johnson retained the Sydney work, and Marsden and Bain were stationed at Parramatta, the duties there becoming more arduous as the population grew. Johnson and Marsden took it in turns to visit Norfolk Island. But settlement began to extend; in 1794 the Hawkesbury valley was settled, and round Parramatta grew up the villages of Prospect, Toongabbie and Castle Hill, all three requiring periodical visits. Again the work was expanding beyond the strength of the chaplains, and, to add to it, on 15 December 1794 James Bain left the colony, and Marsden had to take over the military chaplainship. In September 1796 he opened at Parramatta a temporary chapel, built from material obtained by pulling down two huts, and this structure served its purpose till a permanent building could be erected. The foundation of such a building was laid on 5 April 1797, and it was called 'St. John's' after Governor Hunter, who had assisted the chaplains in every way since his arrival in September 1795. On 1 October 1798 Johnson's temporary church at Sydney was burnt down in circumstances that showed that the burning was wilful. Hunter then granted Johnson the use of a store on the east side of the Cove, near the present customs-house, and services were held there on the following Sunday. On 7 October Hunter laid the foundation-stone of a new church on Church Hill.

In May 1798 there arrived in Sydney a number of missionaries from Tahiti, who had been sent there in the ship *Duff* some time previously, but, fearing massacre, had sought shelter in the brig *Nautilus*, a trader from Sydney. Hunter permitted them to settle in the colony. Among them was Rowland Hassall, who was enlisted as a catechist and sent to Parramatta to assist Marsden. Hassall at once interested himself in the religious needs of Kissing Point (now Ryde) on the Parramatta River, obtained subscriptions from the settlers, and built there a church which was opened on 16 July 1800 by the two chaplains. The church building was used as a schoolroom during the week, and the governor appointed Matthew Hughes (afterwards well-known as schoolmaster and parish clerk at Richmond) to be schoolmaster. The records show that 20 scholars attended the school from its inception.

At this stage Johnson, who had applied to the colonial office for leave of absence owing to failing health, left the colony with Hunter in H.M.S. *Buffalo*. This made Marsden the only official chaplain in the colony, with one catechist to assist him. Marsden immediately arranged to undertake all the duties, enduring much fatigue and hardship in the performance of them; he regularly served Parramatta and Sydney, and visited the other settlements whenever opportunity presented itself. In the mean-

An Estimate of the Expenses in building a Place of Worship at Sydney New South Wales.

The different work men employed —	Spirits	Tea	Rock	Brick	Tobacco	Tea	Computed Price of the above Provisions			The Real Price of D° —			Paid in Dollars &c.			Computed Price of D° whole Building			Real Price of D° —		
	lb	Ds	Ps	Ds	Ds	Ounces	£	s	d	£	s	d	£	s	d	£	s	d	£	s	d
Cutting Posts, Raffers &c —	2 1/4	37	4	7	—	—	2	11	4	1	9	8 1/2	1	10	6	4	1	10	3	0	2 1/2
D° — Grass —	4	46	11/4	20	—	—	3	15	3 1/2	2	5	7 1/2	3	10	6	7	5	9 1/2	5	16	1 1/2
Long Boat & my own D° — bat	4	9	—	—	—	5	2	17	0	1	2	6	4	12	0	6	19	0	5	14	6
Sawyers for 1750 of Plank.	4	—	—	—	—	—	2	0	0	0	18	0	5	4	6	7	4	6	6	2	6
Thatcher —	1/4	—	—	—	—	—	0	2	6	0	1	1 1/2	4	0	0	4	2	6	4	1	1 1/2
Timber Carriage —	—	—	—	—	—	—	—	—	—	—	—	—	3	18	6	3	18	6	3	18	6
Outside Carpenters	5	22	3/2	6/2	3	—	3	8	8	1	15	9	13	15	0	17	3	8	15	10	9
Wattler & Plasterer —	—	—	—	—	—	—	—	—	—	—	—	—	4	10	0	4	10	0	4	10	0
Labourer to D° —	—	—	—	—	—	—	—	—	—	—	—	—	3	15	0	3	15	0	3	15	0
Tempering & Wheeling Clay —	1/4	—	—	—	—	—	0	2	6	0	1	1 1/2	1	0	0	1	2	6	1	1	1/2
Levelling ground & other work	—	—	—	—	—	—	—	—	—	—	—	—	2	17	6	2	17	6	2	17	6
Inside Carpenters —	1/4	—	—	—	—	—	0	2	6	0	1	1 1/2	6	13	6	6	16	0	6	14	7 1/2
Blacksmith —	—	—	—	—	—	—	—	—	—	—	—	—	2	5	6	2	5	6	2	5	6
Glazier —	—	—	—	—	—	—	—	—	—	—	—	—	0	5	0	0	5	0	0	5	0
51 Bull Heads d° each	—	—	—	—	—	—	—	—	—	—	—	—	2	0	6	2	0	6	2	0	6
Total —	20 1/2	116	18 3/4	33 1/2	3	5	14	9	9 1/2	7	14	11 1/2	59	18	0	74	7	9 1/2	67	12	11 1/2

That the above is to the best of my knowledge a just Estimate of the Expenses in erecting the above Building I am willing to be upon oath of at any time or by any Person I am required —

Sydney Sepr 3^d 1793 — Richard Johnson Chaplain

NB The amplified Price of Spirits is 10 Gall Hour of 6 Ds Pond d° — Oz of Thread 1/4 — Sta 8.
The Real Price is they cost 2c — 4/6 — 4 — 6 — 4 — 8 — 5.
The above Estimate is quarter exclusive of the Labour of any one
Servants which, altogether, was then about eighty days —

Johnson's Statement of Moneys Expended for the First Church.

time he pushed on with the building of St. John's at Parramatta, and opened it on Easter Sunday, 10 April 1803. The church was described as the best public building in the colony; it was 100 feet long by 44 feet wide, and attached to it was a room 20 feet long raised on stone pillars for use as a vestry.

On 23 July 1802 Governor King divided the colony into two parishes. The order stated 'that in all Spiritual, Judicial, and Parochial Proceedings, Transactions, Deeds, Instruments, and Registers, that the Districts of Sydney, Petersham, Bulanaming, Concord, and Liberty Plains, be comprised with a Parish to be henceforward named "Saint Phillip," in honor of the first Governor of this Territory; and that the Districts of Parramatta, Banks' Town, Prospect Hill, Toongabbie, Seven Hills, Castle Hill, Eastern Farms, Field of Mars, Northern Boundaries, Ponds, and Kissing Point, be comprised with a Parish to be henceforward named "St. John's," in honor of the late Governor, Captain John Hunter; and that the Churches now building at Sydney and Parramatta be respectively named Saint Phillip and Saint John.' On 1 March King had complained to the colonial office that there was only one clergyman in the colony to do the work, and asked (without success) that an appointment should be made. It being impossible for Marsden to visit Norfolk Island, King took it upon himself to appoint a clergyman, one Henry Fulton (q.v.), who had arrived on 11 January 1800 with a number of convicts from Ireland. Fulton had been deported for sympathizing with those concerned in the rebellion of 1798. The colonial office approved of the appointment, and authorized the payment of Fulton's salary £96 per annum.

In 1804 Pascoe Crook (q.v.) one of the Tahiti missionaries already referred to, who had not come to Sydney but had returned to England, arrived in the colony in the store-ship *Ocean*. He was at once appointed schoolmaster at Parramatta and catechist to assist Marsden in the outlying settlements. On 1 March 1804 King again called the attention of the colonial office to the fact that there was only one chaplain in the colony, adding that he had appointed three catechists 'with their families to be victualled and receive other indulgencies as a recompence for their reading prayers and preaching every Sunday at those settlements that the Rev'd Mr. Marsden cannot attend.' The three were Hassall at Kissing Point, Crook at Parramatta, and Harris (another missionary from Tahiti) at the Hawkesbury. For Harris King erected a building to serve as a church on Sundays, a schoolhouse during the week, and a residence for the schoolmaster as well, Harris acting as schoolmaster in 1805-8. In a summary of the state of the colony made by King (apparently for Bligh's use) on 12 August 1806 the situation with regard to chaplains is thus described:—'Since Mr. Johnson's resignation in 1801, that duty has been performed by the Rev. Mr. Marsden with much assiduity and zeal. A church is built at Parramatta, and one of stone is far advanced at Sydney, the first of which has obtained the name of St. John, and the latter that of St. Phillip. Exclusive of Divine service being performed each Sunday at those settlements, two missionaries of good character perform Divine service at Hawkesbury, Castle Hill, and Kissing Point, with great advantage to the inhabitants. After a residence of thirteen years, Mr. Marsden has obtained my leave to go to England on account of indisposition and to arrange his private concerns; and that the important duties of religion may not be neglected, the Rev. Mr. Fulton, chaplain of Norfolk Island, does Mr. Marsden's duty in these settlements during his intended absence.' Marsden sailed in H.M.S. *Buffalo* on 10 February 1807, and Fulton was left in sole charge. Bligh, who thought him 'a moral, good man,' pointed out in a despatch of 7 February 1807 that the colonial office must either confirm Fulton's appointment or at once send out more chaplains. The appointment was not confirmed until 31 May 1811, and in the meanwhile Marsden—who was on the look-out for assistants from the moment he reached England—had secured the services of William Cowper and Robert Cartwright. Before, however, they could reach Sydney the New South Wales Corps had deposed Bligh, suspended Fulton for sympathizing with him, and put Crook in his place as principal chaplain. Cowper, who reached Sydney in advance of Marsden on 18 August 1809, was on the 22nd appointed assistant chaplain.

On 1 January 1810 Lachlan Macquarie assumed the governorship, and at once reinstated Fulton. On 27 February Marsden and Cartwright arrived, and the situation became normal again, Marsden taking Parramatta, Cowper the Sydney parish (St. Philip's), and Cartwright the Hawkesbury. Fulton went to England with Bligh, who required him as a witness. Macquarie, who had a stern sense of religious duty, aided the chaplains greatly. The lax observance of the Sabbath shocked him: he ordered that all convicts in government employ, and all ticket-of-leave men, should be mustered every Sunday morning and marched to church at one of the three settlements. He also established a scale of fees for marriages, christenings and funerals, and insisted that registers should be kept. Before the end of his first year of office he had completed the building of St. Philip's church, the name of which he altered to conform to the recognized spelling of the real saint's name. The foundation-stone of this church was (as has been already mentioned) laid in 1798; a large clock for the tower had been sent out in 1797, and temporarily erected on the slope of Church Hill; a peal of eight bells cast in 1794 by T. Mears of London, and brought out by Governor Hunter, was hung in the church tower on 29 May 1807. This peal was afterwards distributed, three bells only being retained; it is probable that five were sold by auction in 1833, as an advertisement of that year includes 'Church Bells' among obsolete government stores for sale—but the authority for this action cannot be traced. The three that remained disappeared when the old church was demolished in 1856, but have in recent years been rediscovered—one in 1885 at a Church of England school in Randwick (a suburb of Sydney), one in 1911 in use on the lightship *Bramble* in Port Jackson, and a third in 1917 at Bourke gaol. In 1804 George III presented the colony with a fine service of Communion plate, which was kept for use in St. Philip's; tablets setting forth the Creed and the Ten Commandments were also sent from England, but the building which was to house them was long in construction. Macquarie hastened the opening, which took place on 25 December 1810.

In 1812 Fulton returned from England with a commission as assistant chaplain, and was appointed to St. Philip's to assist Cowper. In 1814 he was transferred to the Hawkesbury (by then divided into the parishes of Castlereagh and Richmond) and served there till his

death. In 1816 John Youl, who had succeeded Harris as catechist at the Hawkesbury and had afterwards gone to England to be ordained, returned to Sydney with a commission appointing him assistant-chaplain at Port Dalrymple; on his arrival, however, Macquarie sent him to Liverpool until proper accommodation could be provided for him at Launceston. In 1819 this condition was fulfilled, and Youl took up his duties at Launceston in November. Both Hassall and Youl held services in the Ebenezer chapel at the Hawkesbury, which, though erected primarily for Presbyterian services, soon became a 'mixed community chapel.'

Meanwhile Marsden was becoming restive. The bounds of settlement were extending widely and the population increasing with great rapidity, yet no extra assistance could be procured from England. He urged on Macquarie again and again that applications by letter to the authorities in London were useless, and that only the presence in England of someone able to give full information about Australian conditions could avail to procure the requisite help. Macquarie, unfortunately, was convinced that Marsden wanted to go to England only in order to join Jeffery Bent in attacking his administration, and refused to let the senior chaplain leave the colony. In May 1818 he sent the colonial office an urgent despatch on the need of more chaplains, and in December relief was at last given.

On 18 June 1819 Richard Hill arrived in the *Hibernia*, and was appointed to assist Cowper, whose duties were ever increasing. Eight days later John Cross arrived, and was stationed at Windsor; Cartwright was sent to Liverpool, thus leaving Youl free to proceed to Launceston. B. Vale, who also came out about this time, quarrelled with the governor and returned after a stay of a few months. In 1822 Hassall, who had gone to England to be ordained, returned and went to Parramatta to assist Marsden; later he was appointed to St. Paul's, Cobbitty, from which centre he served the area extending to Goulburn on the south, Wollongong on the coast, and Mulgoa westwards. In January 1820 George A. Middleton arrived, and in September Thomas Reddall; the former went to Newcastle and the latter to Campbelltown. By this time Sydney had grown so large that it was decided to divide it into two parishes, St. Philip's on the west side and St. James's on the east. On 7 October 1819 Macquarie laid the foundations of the new parish church, which was consecrated on 11 February 1824. Churches were also built or begun in Macquarie's time at Windsor (1820), Liverpool (1819), Campbelltown, and Newcastle, and he ordered the erection of a church at Port Macquarie which was begun in December 1824, with Hassall as chaplain to the settlement. The Liverpool church (St. Luke's) is claimed to be the oldest Anglican church now existing in Australia; it has lost its Macquarie portico, but retains over its entrance door the inscription that records its erection in 1819. It was completed in 1824; Robert Cartwright was its first incumbent.

At the foundation of the colony there was no Church authority extant, except that by an order-in-council of Charles I all British subjects outside Britain were under the jurisdiction of the bishop of London. The chaplains were civilian or military officials performing spiritual functions. But technically Australia and Tasmania were within the limits of the East India Company's charter of 31 December 1600; and when in May 1814 a bishopric of Calcutta was created it was expressedly stated to include all British territory within those limits, and so brought Australia and Tasmania for the first time under episcopal jurisdiction. When in 1824 New South Wales attained a certain degree of self-government by the grant of a legislative council, the ecclesiastical position also was regularized; in May the jurisdiction of the bishop of Calcutta was formally reaffirmed, and on 2 October the colony was constituted an archdeaconry of the Calcutta diocese, Thomas Hobbes Scott (q.v.) being appointed the first archdeacon. He reached Sydney on 7 May 1825, and at once entered on the work of organizing his clergy. Simultaneously with his appointment the colonial office drafted a scheme for setting aside lands in the several counties—to comprise 'one seventh part in extent and value of all the lands in each County'—from whose revenues should be obtained 'an adequate provision for the support of the Clergy of the Established Church of England throughout the colony, and for the Education of Youth in the principles of the Church.' These lands were to be administered by a corporation of officials, with the governor and archdeacon at their head, to be known as 'The Trustees of the Clergy and School Lands.' The mere existence, however, of this body created such an outcry among supporters of other denominations—notably the Roman Catholics and Presbyterians—that in 1829 the colonial office decided to abolish the trust, which had been allotted its first estates (amounting to 393,283 acres in all) only in February of that year. The usual delays followed. On 19 June 1830 formal instructions were issued to Darling to substitute for the trust a commission of five members; on 14 February 1831 the order to reserve lands in the several counties was cancelled; legal objections raised in the colony kept the trust intact a year or two longer; but on 4 February 1833 an order-in-council explicitly dissolved it, and in 1834 an act of the New South Wales legislative council provided for the future management of the church and school estates, which were resumed by the crown. To make up for the loss of revenue to the ecclesiastical establishments a sum of £30,000 was voted annually, to be divided between the Anglican, Roman Catholic, Presbyterian, and Wesleyan bodies. This grant was reduced to £28,000 on 1 July 1851, when Victoria became a separate colony.

The first service west of the Blue Mountains was conducted in the public granary at Bathurst on 13 October 1822 by Samuel Marsden, whose son-in-law Thomas Hassall (son of Rowland Hassall already mentioned) was appointed to the parish of Bathurst in 1826. The parish extended from Hartley westwards to Boree (beyond Orange) and south-west to Carcoar. Hassall established temporary chapels at Kelso and O'Connell, but in 1827 was transferred to Camden and succeeded by John Espy Keane. Holy Trinity church at Kelso was opened by Samuel Marsden in 1835, and consecrated by Bishop Broughton on 3 December 1836. In 1840 a minister was appointed to the 'parish church of All Saints at Bathurst,' but the foundation-stone of this church was not laid until 24 January 1845, and services were first held in it in 1848. It was consecrated on 14 December 1849. On 6 May 1870 it became the cathedral church of the Bathurst diocese.

Reverting to the affairs of the Church as a whole, Archdeacon Scott resigned in 1828, and William Grant Broughton (q.v.) was chosen on 7 December of that year to succeed him.

Broughton arrived in the colony on 13 September 1829 and was sworn in by the governor on the 17th. The Church was progressing *pari passu* with the colony, but the clergy were enduring many hardships. Archdeacon Scott in 1829 stated that their families were often 'obliged to forego the use of meat and flour and subsist on a less substantial diet.' Cartwright out of a salary of £250 per annum spent, one year, £150 in maintaining a horse for his parochial duties. One of the few compensations was the grant of 1250 acres of land regularly made by the colonial government to a clergyman's daughter on her marriage.

By 1833 there were 15 clergymen in the archdeaconry, and separation from Calcutta became advisable. In 1834, therefore, Archdeacon Broughton proceeded to England, and after consultation with the home authorities it was decided to raise the colony to the dignity of a separate see. This was done on 18 January 1836, William Grant Broughton being appointed the first bishop; the see was to be subordinate to Canterbury, and was endowed with a sum of £3000. King William IV presented two services of Communion plate for diocesan use. By this time the population of Sydney had grown to 20,000; a new parish (St. Lawrence) was therefore formed, and services were held in a temporary building while Christ Church was being built. When Bishop Broughton on 2 June 1836 returned to Sydney, he set to work to organize the new diocese thoroughly. In November he requisitioned the government for at least nine more clergy. Appeals for funds to build churches, schools, and vicarages were readily answered by the English Church Society and the colonists, and in 1837 the bishop was able to report that £13,000 had been raised locally (for the most part in small amounts) and £4000 had been sent from England. The diocese, however, was already becoming too unwieldy. Tasmania was a long journey from Sydney; new centres were being opened up as far north as Moreton Bay; Port Phillip was growing rapidly, and at Adelaide another settlement had been made, so that it became impossible for the bishop to visit the various areas of his great see with any degree of regularity. The first step towards a division of the see was taken on 18 August 1842, when Tasmania was made a separate diocese. A little later it was decided to divide the mainland into four sees —Sydney, to include all the southern portion of New South Wales; Newcastle, all the northern portion, including the Moreton Bay district; Melbourne, to include all the Port Phillip district; and Adelaide, to include South and Western Australia. This division was made possible by help from the colonial bishoprics fund and by the munificent gifts, especially to Adelaide, of Angela Burdett-Coutts. By 25 June 1847 all that was wanted was a bishop for each diocese, and on the 29th the three new bishops were consecrated in Westminster Abbey, William Tyrrell for Newcastle, Charles Perry for Melbourne, and Augustus Short for Adelaide. Bishop Broughton was made bishop of Sydney and metropolitan of Australia. All these sees have since been much subdivided: the several dioceses are dealt with below under the names of the States in which they are situated, and many important events in their history are narrated under the names of the bishops most closely connected with them.

New South Wales.—Bishop Broughton died in 1853 while on a visit to England, and William Cowper (by this time an archdeacon) administered the diocese of Sydney pending the appointment of a successor from England. On 30 November 1854 Frederick Barker, vicar of Baslow in Derbyshire, was consecrated bishop; he reached Sydney on 25 May 1855, and was installed on the 31st.

The discovery of gold brought a great influx of population, and the difficulty of obtaining clergymen from overseas caused the authorities to establish a training-school in the colony; in this they were materially assisted by the will of Thomas Moore of Moorebank near Liverpool in New South Wales. In 1840 Moore had left all his property to the Church, and assigned Moorebank as a college for the education of youths between the ages of 16 and 23 in accordance with the doctrines of the Church of England. By 1856 the income had so far increased that Bishop Barker was able to establish a college with William Hodgson, of Sidney Sussex College, Cambridge, as principal. Bishop Broughton had previously established a college at Lyndhurst House in the Glebe (a suburb of Sydney) with Robert Allwood as principal; both secular and divinity students were trained there, but the venture failed for lack of support. Hodgson did not arrive till August 1856, and William M. Cowper (afterwards Dean Cowper) took up his residence at Moorebank as temporary principal. When Hodgson did arrive, the trustees decided to build a chapel, hall, library, and rooms for students. The parish of Holdsworthy was placed under the charge of the principal, and the students were detailed to take services and assist the rector of Parramatta in the outlying portions of his parish. On 17 December 1857 the college chapel was opened and licensed as Broughton Chapel (in memory of the late bishop); an appeal to the community supplied the remainder of the money, and the college was opened free of debt. Bishop Barker while in England also appealed for funds, and a sum of £4000 was subscribed. In 1868 Hodgson resigned, and Robert Lethbridge King was appointed; when he resigned in 1887 the vice-principal, George Sheppard, directed the work until A. L. Williams arrived in August 1888. In 1889 the college was moved from Liverpool to new buildings near the university of Sydney. Its heads have been T. E. Hill (1889), B. A. Schleicher (1891-97), Nathaniel Jones (1897-1911) and David John Davies.

Bishop Barker hastened the completion of St. Andrew's cathedral at Sydney. This church was originally planned by Governor Macquarie to provide additional accommodation for the Anglicans of his time, the 'Old Church' of St. Philip's becoming overcrowded by about 1818. In 1819 Macquarie laid the foundation-stone of 'an intended Church on a large scale in the Center of the Town (at the junction of "George Street" and "Bathurst Street")'—a site which he had marked out as far back as 1812; but Bigge insisted on the abandonment of this scheme, and provided the necessary accommodation by converting Macquarie's half-built court-house into St. James's church. On 16 March 1837 Governor Bourke laid a new foundation-stone on the George-street site, and efforts were made spasmodically to erect a suitable cathedral building; but lack of funds and the abnormal labour conditions of the gold-rush period hampered the work so that little progress was made until Barker's time. The cathedral was completed and opened on St. Andrew's day, 30 November 1868. The western towers were added in 1874, and the chapter house (as a memorial to the bishop) in 1886. In 1856 Barker also founded

the Church Society, which since the abolition of state aid has been the chief instrument in the creation of new parishes in the diocese. In 1872 it was decided that on two Sundays in the year the whole of all church collections within the diocese should be devoted to the funds of the Church Society. Under the name 'home mission fund' bodies of this nature operate in every diocese in Australia.

Synods were instituted during this period for the regular working of the diocese. In 1866 an act of parliament enabled the Church to manage its own property. On 5 December of the same year the Sydney diocesan synod was first called together, and it has since met annually. Out of this synod grew the synod of the province, to which clerical and lay representatives from every diocese are elected. The provincial synod receives appeals from diocesan synods against the vote of the bishop, and legislates on any matter referred to it by any diocesan synod. The first provincial synod met on 11 May 1869. In 1872 a general synod of the Anglican Church in Australia was formed to deal with matters sent up from provincial synods, and to legislate for the appointment or trial of bishops; but any determination of general synod must be adopted by a diocesan synod before it becomes law in the diocese. General synod meets every fifth year, and is presided over by the primate; in the absence of a primate, in accordance with decrees made by general synod in 1900, the house of bishops elects one of the metropolitan bishops to act in his place. A new constitution was framed in the Church of England constitution act of 1902.

During Barker's episcopate the southern portion of the see of Sydney was (on 14 March 1863) formed into the diocese of Goulburn, with Mesac Thomas as bishop. The western portion was proclaimed the diocese of Bathurst in 1869, S. E. Marsden (grandson of Samuel) being made bishop, and installed on 5 May 1870. On 6 April 1882 Bishop Barker died, and was succeeded by Alfred Barry on 24 April 1884. Dr. Barry resigned in 1889, and his successor, William Saumarez Smith, took office in the following year. In 1897, during his occupancy of the see, the diocese was raised to the dignity of an archbishopric by resolution of general synod. Dr. Smith died on 18 April 1909, and was succeeded by John Charles Wright who was consecrated on 24 August 1909. All except the last-named held the position of primate and metropolitan of Australia by virtue of their office as bishop or archbishop of Sydney; Dr. Wright was elected by the bishops of Australia.

During the episcopate of Bishop Tyrrell the Newcastle diocese was in 1859 relieved of the charge of the Brisbane district, and was again diminished in 1869 by the formation of the diocese of Grafton and Armidale. Tyrrell died on 24 March 1879, and Josiah B. Pearson took his place; he resigned in 1889, and was succeeded in 1891 by George Henry Stanton, who was translated from the diocese of North Queensland. In 1906 John Francis Stretch was appointed to the see; he was succeeded in 1919 by Reginald Stephen, who was translated from Tasmania. On 24 February 1869 James Francis Turner was consecrated bishop of the new diocese of Grafton and Armidale; he was succeeded in 1901 by H. E. Cooper, who had been coadjutor at Ballarat since 1895. In 1914 the diocese was again divided, Grafton being separated under Cecil Druitt, who since 1911 had been coadjutor in the undivided diocese. Bishop Cooper was succeeded at Armidale in 1916 by W. F. Wentworth-Shields, and Bishop Druitt at Grafton in 1921 by John William Ashton. At Bathurst Bishop Marsden held office until 1885, and was succeeded in 1887 by Charles Edward Camidge. On 30 November 1911 George Merrick Long took over the diocese, and is still (1925) in office. In 1884, during the episcopate of Mesac Thomas, the diocese of Goulburn was diminished by the formation of the diocese of Riverina under Dr. Sydney Linton. Dr. Thomas was succeeded in 1892 by William Chalmers. In 1902 Christopher George Barlow was translated to the see from North Queensland; he was succeeded in 1915 by Lewis B. Radford, the present bishop. Bishop Linton of Riverina was succeeded in 1895 by Ernest Augustus Anderson, who resigned at the end of 1924.

Tasmania.—On 27 January 1804 Lieutenant-governor David Collins founded a settlement at Hobart. Robert Knopwood (q.v.), his chaplain, conducted the first services in a tent, pending the erection of a church. At Port Dalrymple Lieutenant-governor Paterson appointed one Edward Main of H.M.S. *Buffalo* to look after the spiritual welfare of the place. On 19 February 1816 was laid the foundation-stone of the first church in Hobart, which was named 'St. David's' in honour of Lieutenant-governor David Collins. Youl took up his duties at Launceston in November 1818, and in 1822 W. Bedford was appointed chaplain at Hobart. Knopwood retired on 27 April 1823, and died on 8 November 1836. On 28 December 1824 the foundation-stone of St. John's at Launceston was laid, and 12 months later the church was fit for divine service. In this year (1825) Samuel Marsden consecrated St. David's at Hobart. Bedford, supported by Governor Arthur, pushed on with every branch of his work, and progress became rapid. The next governor, Sir John Franklin, was an ardent churchman, and during his regime more chaplains were brought out to assist in the growing work; among them came John Philip Gell, who interested himself largely in educational matters. When Tasmania was made a separate diocese in 1842, Francis Russell Nixon was appointed to the see. He was succeeded in 1864 by Charles Henry Bromby, who retired in 1882; Daniel Fox Sandford, the next appointee, was succeeded in 1889 by Henry Hutchinson Montgomery. His successor was John Edward Mercer, who resigned in 1914; Reginald Stephen, late dean of Melbourne, then became bishop, and on his translation to Newcastle in 1919 Dean Robert Snowdon Hay was consecrated, and is the present bishop (1925).

Victoria.—The first service in Victoria was held in 1834, in a barn on the Henty property at Portland; the barn was used for this purpose until it was replaced by a brick church in 1841. When the town of Melbourne was laid out in 1836, a small wooden church was erected on a site of five acres reserved for the use of the Church of England. Some zealous laymen ministered to the congregation until the arrival in 1838 of John Couch Grylls (q.v.); during the same year Bishop Broughton paid his first visit to the settlement. In 1839 the foundation-stone of St. James's church—which later became the pro-cathedral—was laid by Governor Latrobe. In September 1843 Bishop Broughton paid a second visit to the settlement, and laid the first stone of Christ-church, Geelong, on a site of two acres given by the government. In January 1846 the colonial government promised a sum of £11,000 towards the cost of St. James's,

providing an equal amount was subscribed by the public; Bishop Broughton added £500 to the building fund. In the same year work was begun on the church of St. Peter at Eastern Hill. In 1847 Melbourne became a separate diocese, with Charles Perry as first bishop; he was consecrated on 29 June, and held the diocese until his retirement in 1875. On 1 May of that year the diocese was divided, the western portion being constituted the diocese of Ballarat. James Moorhouse (q.v.) succeeded Perry at Melbourne; during his episcopate the foundation-stone of St. Paul's cathedral in Melbourne was laid on 13 April 1880, but the building (which was designed by the English architect Butterfield) was not completed and opened until 22 January 1891, in the time of his successor. When Moorhouse was translated to Manchester in 1886, Field Flowers Goe became bishop; he resigned in 1901, and during the interregnum the diocese was again subdivided, the dioceses of Bendigo, Wangaratta, and Gippsland being created in 1902. Henry Lowther Clarke was installed as next bishop on 3 March 1903. In 1905 Melbourne was raised to the dignity of an archbishopric. Archbishop Clarke resigned in 1920, and was succeeded by Harrington Clare Lees in February 1921.

The first bishop of Ballarat was Samuel Thornton; he was succeeded by Arthur Vincent Green, who was translated from Grafton and Armidale in 1900. When Dr. Green retired in 1917, M. H. Maxwell-Gumbleton of Bristol became bishop. The first bishop of Bendigo was Henry Archdall Langley, who was succeeded by his brother John Douse Langley in 1907. The present bishop, Donald Baker, took office in 1921. In 1902 Thomas Henry Armstrong was consecrated bishop of Wangaratta. Gippsland's first bishop was Arthur Wellesley Pain, who was succeeded by George Harvard Cranswick, the present bishop, in 1917.

South Australia.—The first chaplain, Charles Bernard Howard (q.v.), came out with Captain Hindmarsh in H.M.S. *Buffalo*. He conducted his early services in a tent, but soon began to erect the more permanent Trinity church; owing to financial troubles its construction was delayed, and he died in 1843 before he could complete it. His assistant James Farrell, who had arrived in 1840, carried on the work from 1843 to 1846, when Archdeacon Woodcock and James Pollett came to his assistance; G. Newenham and W. H. Coombes joined them later, and Coombes was stationed at Gawler. On 25 June 1847, by the munificent aid of Angela Burdett-Coutts, the see of Adelaide was established, and the first bishop, Augustus Short (q.v.), reached Adelaide on 28 December, and was installed in January 1848. He was soon faced by unforeseen difficulties, decisions of the local supreme court (which were confirmed by the privy council) depriving him of the cathedral-site which had been reserved by governors Gawler and Robe, and annulling the royal letters patent which had purported to confer on him a certain territorial and ecclesiastical jurisdiction within his diocese. Thus made head of a purely voluntary society with no privileges, Dr. Short threw himself ardently into the work of establishing his branch of the Church of England in a dignified and unassailable position; he traversed the diocese repeatedly—especially after 1856, when Western Australia was severed from it—and in his term of 34 years built up an organization with a synod, dean and chapter, endowments, church offices, a diocesan library, a theological college (St. Barnabas), two church grammar schools (St. Peter's college and the Pulteney school), and a partly built cathedral. When Short became bishop, the diocese had five ministers; when he resigned, it had 50, besides 212 lay readers.

In November 1881 symptoms of heart disease compelled his resignation. His successor was George Wyndham Kennion, whose term is notable for the establishment of a home mission society of the type founded by Bishop Barker in Sydney, and of a mission steamer which ministered to both the spiritual and the material needs of settlers along the Murray River. In 1894, having added more than 40 churches to the diocesan organization, Dr. Kennion was translated to the English see of Bath and Wells, and was succeeded by John Reginald Harmer, a well-known scholar and the literary executor of Bishop Lightfoot. During his episcopate the country parishes and missions were increased and systematized, and the cathedral was completed (the nave in 1901, the towers in 1902). In 1905 Dr. Harmer was translated to the English diocese of Rochester, and in 1906 Arthur Nutter Thomas became bishop. During his term the theological college has been enlarged and improved, a college (St. Mark's) has been established in affiliation with the university of Adelaide, the Pulteney school has been rebuilt on a better site, a Church secondary school for girls has been founded, the home mission fund has been extended in scope, and the stipends of mission clergy have been increased. In 1915 the northern archdeaconry was constituted the independent diocese of Willochra, Gilbert White being transferred from Carpentaria to become its first bishop. The diocese of Adelaide has now (1925) 106 ministers, 290 lay readers, and 178 churches: that of Willochra has 19 ministers, 68 lay readers and 44 churches.

Western Australia.—In 1848 Bishop Short of Adelaide, accompanied by Matthew Blagden Hale, paid a visit to Western Australia, then a portion of his huge diocese. At King George's Sound on 20 October they consecrated a stone church (which had been built in the rectorate of John Wollaston), and passed through Busselton, Bunbury, Picton, and Fremantle to Perth. There were then six clergymen in the colony, four of them in receipt of government stipends of £100 per year; the Church population numbered about 3700. They consecrated a church built for Postlethwaite on the upper Swan River, and another at St. George, and visited the middle Swan district, which was in the charge of W. Mitchell. The Adelaide diocese was far too large, and in 1856 was diminished by the formation of the diocese of Perth, with Hale as bishop. He remained in charge until 1875, when he was translated to Brisbane; he was succeeded by Henry Hutton Parry, coadjutor-bishop of Barbados, who was installed on 20 May 1877. Bishop Parry officiated till his death on 18 October 1894; his successor was Charles Owen Leaver Riley. Perth was raised to the dignity of an archbishopric in 1914.

In 1904 Frederick Goldsmith was appointed to the diocese of Bunbury, which had been created in the preceding year; Cecil Wilson became its bishop in 1917. In 1914 the diocese of Kalgoorlie came into being, with Cyril Henry Golding-Bird as bishop; he was translated to the Mauritius in 1919, and succeeded by William Edward Elsey. The independent diocese of North-west Australia was formed in 1910, with Gerard Trower as bishop.

Queensland.—On 18 September 1828 Governor Darling appointed John Vincent chaplain to the penal establishment at Moreton Bay, but he quarrelled with the commandant soon afterwards, and was recalled. The district seems to have been without Anglican ministrations until the end of the thirties, when John Macgregor, the first licensed clergyman, was appointed. In 1847 his charge became part of the new diocese of Newcastle. In 1848 Macgregor was succeeded by Benjamin Glennie, who was later assisted in his pioneering work by Robert Creyke and John Mosely. On 6 June 1859 Edward Wyndham Tufnell arrived to take charge of the newly-created diocese of Brisbane. He resigned in 1875, and was succeeded by Matthew Blagden Hale, who held the see until his resignation in 1885; William Thomas Thornhill Webber then became bishop. Dr. Webber died in 1904, and St. Clair George Donaldson (see DONALDSON, SIR S. A.) was consecrated bishop on 21 December of that year. In 1905 the Brisbane diocese was raised to the dignity of an archbishopric. Dr. Donaldson was translated to Salisbury in 1921, and Gerald Sharp of British New Guinea became bishop.

In the diocese of North Queensland, founded in 1878, the following bishops have officiated: George Henry Stanton (1878), Christopher George Barlow (1891), George Horsfall Frodsham (1902), and John Oliver Feetham. The first bishop of the Rockhampton diocese, which was formed in 1892, was Nathaniel Dawes (coadjutor at Brisbane, 1889); he was succeeded by George Dowglass Halford in 1909. In 1921 Philip Charles Thurlow Crick became bishop. The diocese of British New Guinea was created in 1898, with Montagu John Stone-Wigg as bishop; he was succeeded by Gerald Sharp, who became archbishop of Brisbane in 1921, and Henry Newton was appointed to British New Guinea in 1922. The diocese of Carpentaria, formed in 1900, has had three bishops—Gilbert White (1900-15), Henry Newton (translated to New Guinea in 1922) and Stephen H. Davies, who has held office since 1922.

The census of 1921 showed that out of a total population (for the Commonwealth) of 5,435,734 about 44 per cent (2,372,830) recorded themselves as belonging to the Church of England; this is a considerable proportionate increase on the figures of 1911, when only 38½ per cent of the population so recorded themselves.

The Legal Nexus.—All colonial branches of the Church of England are part of the mother-Church in so far that there is full inter-communion and constant interchange of clergy and laity—and occasionally of bishops. But some colonial Churches enjoy a considerable degree of autonomy, which has usually been provided for in their original constitution. The Church in Australia, however, is legally a collection of voluntary societies (dioceses formed either by legislative enactment or by consensual compact) each of which has been organized from the first on the basis of integral connection with the mother-Church, and which hold on trust a great deal of property which was given them because they are integral parts of that Church. In so far as they are voluntary societies the dioceses are quite at liberty to alter their rules and methods of procedure in any way the majority in each diocese may choose. As property-holders they have no such liberty; should a majority in any diocese decide to depart from conformity with the Church in England the seceders would risk the loss of all the existing property of the diocese, which could legally be claimed by the minority, however small, that preferred to abide in the mother-Church.

Since 1905 the question of reconstituting the Church in Australia on a purely autonomous basis has been discussed in synod after synod. This desire for autonomy is prompted by dissatisfaction with (*a*) the Prayer-book as it stands and (*b*) the judicial committee of the privy council as a final court of appeal, and by a widespread feeling that both in its name and constitution the Church should make a more direct appeal to Australian national sentiment. The general synod of the Church in Australia has on more than one occasion declared itself in favour of autonomy—in 1921 the voting was 20 bishops, 55 clergy and 48 laymen for autonomy, 19 clergy and 13 laymen against it—but the general synod is, as has been previously explained, powerless except when its decisions have been confirmed by the separate dioceses, and the desired powers can be obtained only by a very complicated process. A bill giving the Anglican dioceses power to alter their standards and formularies of faith and order, and to create for themselves a new 'tribunal of reference,' must be submitted to each State legislature and to the British parliament (since Australian Church property is held in England). If the seven bills are passed without serious amendment, there will be an end of any legal difficulties such as now hamper the reconstitution of the Church of England in Australia as a fully self-governing branch of the Anglican communion.

See Archbishop Clarke's *Constitutional Church Government in the Dominions* (1924), and the biographies of Richard Johnson, Samuel Marsden, and the various bishops elsewhere in this work.

J.V.C.-B.

Cicadas, insects of the family Cicadidae, belonging to the sub-order Homoptera of the order Hemiptera, are the most ancient as well as the most noticeable family of the Homoptera. About 150 species have been described as occurring in Australia, and they form a striking part of our fauna. During the summer they advertise their presence by a shrill, ear-splitting screech, which is sometimes kept up far into the night. Many species are large and handsome insects, and some do considerable damage to forest trees by sucking the sap. They are commonly but erroneously called 'locusts,' and some of the larger species have received apt vernacular names.

In the Sydney district two handsome cicadas are common, the Green Monday (*Cyclochila australasiae*) and the Double Drummer (*Thopha saccata*); the former is usually a vivid green, but there is a yellow variety called Yellow Monday. The drummer is black and red, and is remarkable for the large size of the tympani in the males—whence its name. Other well-known species are the Red-eye (*Psaltoda moerens*) and the Floury Miller (*Macrotristria angularis*), both names well describing the insect's appearance. Plate xix, fig. 7, shows a beautiful cicada from Queensland, *Psaltoda aurora,* allied to the red-eye.

Many species of the smaller cicadas are common, and some beautifully coloured. The most abundant genera are *Melampsalta* and *Pauropsalta,* which only differ from one another in

their venation. Amongst the more peculiar genera are *Cystosoma*, a genus containing the extraordinary bright-green bladder-cicadas, and *Tettigarcta*, an archaic genus confined to Victoria and Tasmania, which contains two hairy species lacking a sound-producing apparatus. In the latter genus the fore-wing shows very strongly a division into a tougher basal and a thinner distal portion (corium and membrane), thus indicating the essential unity of the Homoptera with the Heteroptera.

The life-histories of our Cicadidae have not been investigated, but it is certain that their life-cycle is shorter than that of the American 17-year cicada. Some of the smaller species (e.g. *Melampsalta torrida*) injure young apple-trees by frequent egg-slits, the branch breaking at the injured part. See HEMIPTERA. R.J.T.

Cinnabar. See MINERALOGY.

Cinnamomum, a genus of the family Lauraceae, consisting of trees or shrubs, extending over tropical and subtropical Asia to Japan. Three species are indigenous to Australia. *C. tamala* (Cassia Cinnamon), a large tree with a smooth bark, ranges from Queensland to India, where both leaves and bark are used medicinally —the leaves in the manufacture of a dye for printing calico, the bark as an ingredient in a special military soap. *C. Oliveri* (sometimes called Sassafras) is a tall tree of 60-80 feet, confined to the coastal brushes of New South Wales and Queensland. The bark has a strong aromatic odour and a pleasant astringent taste, and is frequently used by bushmen to improve the flavour of their tea. Its active principles are a volatile oil, with an odour like the North American sassafras, and a peculiar tannin. *C. virens* (Native Camphor Laurel) is a tree up to 90 feet, having a thin, non-aromatic bark and a soft, easily-worked timber.

Citrus, a genus of the family Rutaceae, one species of which is indigenous to eastern Australia. *C. australis* (Native Lime), is a tree of 30 feet, with oval or rhomboid leaves 1-2 inches long—the leaf-stalk not winged—and thorny branches. The fruits are nearly globular (1-1½ inches in diameter) with 3 or 4 slightly compressed seeds; their juice makes an agreeable beverage. The tree has a hard, close-grained, bright yellow timber, of the same texture as the wood of the common orange. For the imported citrus species grown in orchards see FRUIT-GROWING.

Clark, CHARLES (1838-1903), born in London on 19 April 1838 and trained for the ministry at the Nottingham Baptist College, after filling charges at Halifax, London, and Bristol was in 1868 made pastor of the Baptist church in Albert-street, Melbourne. Finding himself extremely popular as a lecturer (a lecture of his on Charles Dickens raised £600 for the Caxton memorial fund), he resigned his pastoral charge in December 1874 and entered on a career as lecturer and public entertainer. In this capacity he toured the Australian colonies, New Zealand, and the United States, and finally settled in England, though he on several occasions revisited Australia. He died in England in 1903.

Clarke, ANDREW (1793-1847), born at St. Kitts in the West Indies in 1793, entered the army at an early age (ensign, 1806; lieutenant, 1808; captain, 1813; major, 1825; brevet lieutenant-colonel, 1838; lieutenant-colonel, 1839) and became an officer in the 46th regiment, with which he came to Australia in 1814. He was almost immediately sent with a detachment to Hobart, where Macquarie made him inspector of public works, but afterwards rebuked him for trafficking in live-stock. He left Hobart for England in April 1816, and in 1818 rejoined his regiment for Madras. From 1839 to 1844 he was governor of St. Lucia in the West Indies, and in 1846 succeeded John Hutt as governor of Western Australia; but the period of service in the tropics (which must have commenced before his St. Lucia appointment) had undermined his health, and during his whole term in Western Australia he was a confirmed invalid. He died at Perth on 11 February 1847. (K.H., 1837.)—A younger brother, James Langton Clarke, was at one time a county court judge in Victoria; and to him Marcus Clarke (q.v.), the son of another brother, William Hislop Clarke, was sent out in 1863 by Andrew's son. J.S.B.

Clarke, SIR ANDREW (1824-1902), son of Colonel Andrew Clarke mentioned above, and cousin of Marcus Clarke the writer, was born at Southsea in Hampshire on 27 July 1824, educated at the military academy at Woolwich, and joined the royal engineers in 1844 (lieutenant, 1846; captain, 1854; major, 1863; lieutenant-colonel, 1867; colonel, 1872; major-general, 1884; lieutenant-general, 1886). In 1846 he was despatched to Tasmania to supervise road-making, and in 1848 transferred to New Zealand for similar work, but was employed also in negotiations with the Bay of Islands tribes, and dissuaded the promoters of a proposed Church of England settlement from establishing it in that district—it was subsequently located at Port Lyttelton. In August 1849 he returned to Tasmania to become private secretary to Sir W. Denison, with whom he had made a firm friendship; the next year he was nominated to the legislative council, and given charge of government measures. In 1853 he was transferred to Victoria as surveyor-general and chief commissioner of crown lands, with a seat in the council, and used his position to carry a useful bill enabling small centres of population to constitute a municipality in their district. When the new constitution came into force in 1855, Clarke's post ceased to exist, but he was at once made surveyor-general in Haines's first ministry and (having been elected by South Melbourne) retained his ministerial position until the defeat of his colleagues in March 1857; he was then, by a curious arrangement, made permanent head of his department without having to resign his seat in the legislature. In 1858 he even carried a vote of censure on the second Haines ministry, but refused to form a ministry himself.

From 1859 to 1863 he reverted to military duties in England; in the latter year he was sent to the Gold Coast, where he acted as chief justice in addition to his military work; in 1864 he was for a time agent-general for Victoria; and in August of that year he took up the directorship of admiralty engineering works, and for the next nine years was responsible for enlarging or constructing the great dockyards at Chatham, Portsmouth, Queenstown, Keyham, Malta, and Bermuda on which British fleets were to be based for many years to come. In 1873 (probably because it was an important naval station) he was made governor of Singapore, and during his term of office there put down local piracy and established more harmonious relations with the chiefs of the

Malay Peninsula. In 1875 he was transferred to India, where until 1881 he controlled the public works department and incidentally established the Indian defence committee. Returning to England in July 1881, he was for a year commandant of the military engineering school at Chatham, and then became inspector-general of fortifications, in which capacity he much encouraged inventors, advocating the use of the Brennan torpedo, the dirigible balloon, and the submarine long before either the admiralty or the war office could be persuaded to countenance them.

In all these years he had not forgotten Australia. In March 1886 he again acted as agent-general for Victoria, and impressed on the Imperial government the necessity of consulting Australia before making definite arrangements about the New Hebrides. In the same year he made an unsuccessful attempt to enter British politics, and consoled himself with directorships of many companies, including the British North Borneo Company. From 1891 onwards he devoted much attention to Australian affairs; he was agent-general for Victoria in 1891-4 and 1897-1902 (and for a short time agent-general for Tasmania also), was made an Australian representative on the Pacific cable board, and in 1900 assisted the Australian delegates in their discussions with the colonial office over the Commonwealth constitution bill. Busy and untiring to the last, he died in London on 29 March 1902. (C.B., 1869; K.C.M.G., 1873; C.I.E., 1877; G.C.M.G., 1885.)

Clarke, George (1823-1913), born at Parramatta in New South Wales on 29 June 1823, was the son of George Clarke, who came out from England as a missionary and in 1824 took his family to the Bay of Islands in New Zealand. There the younger George was once dandled on the knee of the terrible Hongi Ika ('Smell Fish'), the great Ngapuhi chief whose followers—armed with muskets which Hongi had earned in part by his help in compiling a Maori dictionary at Cambridge—in 1821 swept through the North Island like a destroying fire. After a few years at school in Hobart, George Clarke returned to New Zealand, where he was selected in 1841 as interpreter for the first criminal sittings of the supreme court of New Zealand. His work was specially important for the relations of the two races because at this sittings Maketu, a Maori, was tried for the murder of a white woman and her children. Maketu was condemned and hanged, but his fellow-Maoris were satisfied of the justice of the sentence. Clarke, whose mastery of the Maori tongue led him to speak scornfully of the knowledge possessed by the ordinary pakeha Maori, next acted as interpreter for Commissioner Spain, who had to deal with the land-purchase claims of the New Zealand Company and other traffickers in land. Clarke's advocacy of the rights of the Maoris made him very unpopular with some of the claimants. In 1844 he helped to arrange the purchase from the Maoris of 400,000 acres for the Scots colony of Otago, and he afterwards pointed with pride to the fact that no dispute ever arose over this deal. In 1846 Clarke left New Zealand to study for the Congregational ministry, and in 1851 became the minister of the Collins-street (afterwards Davey-street) Congregational church in Hobart, of which he retained charge for 52 years. He died at Hobart on 10 March 1913.

His learning, eloquence, saintly life, and zeal for education and religion, combined with a broad outlook and a genuine humanity, gave him an influence in the community such as perhaps no other man of his time possessed. With J. B. Walker (q.v.) and a few others he worked for the introduction of higher education, brought the university of Tasmania into existence against what seemed almost hopeless odds, and was its chancellor from 1898 to 1907. T.D.

Clarke, Sir George. See Sydenham, Lord.

Clarke, Marcus Andrew Hislop (1846-1881), born at Kensington on 24 April 1846 and educated at Chomley school, Highgate, on his father's sudden death was sent in 1863 by his cousin Andrew to Melbourne, where his uncle James Langton Clarke, a county court judge, secured him a clerkship in the Bank of Australasia. A few months' experience convinced him of his unfitness for office life, and in January 1865 he went off to gain 'colonial experience' on John Holt's station near Glenorchy on the Wimmera River; here he made acquaintance with bush types, acquired a modicum of bushcraft, and began to send sketches to the *Australian Magazine* under the *nom de plume* of Mark Scrivener. Tiring of bush life as of office life, he abandoned pastoral pursuits after a year's trial, and in February 1867 through the influence of Dr. Robert Lewin became a member of the literary staff of the *Argus* and *Australasian.* His serious work—reporting and leader-writing for the *Argus*—was on the whole a failure, but his contributions to the weekly paper, especially the series signed by 'The Peripatetic Philosopher,' soon brought him into notice. Always restless, however, in 1868 he (while continuing his work for the *Argus,* etc.) purchased the *Australian Magazine,* renamed it the *Colonial Monthly,* and in it published his first and weakest novel *Long Odds,* of which he wrote only the first five chapters. In May of that year he and some friends established the Yorick club. The *Colonial Monthly* was short-lived; he began to write verse and prose for the Melbourne *Punch,* but about the middle of 1869 brought out a rival comic paper *Humbug,* which lasted just three months. He then approached the publishers of the defunct *Humbug* with a proposal for a sensational convict novel, to be published in their *Australian Journal.* The offer was accepted, and he was sent to Tasmania to improve his health and pore over prison records. The result was *For the Term of His Natural Life,* which appeared serially in the *Australian Journal* between March 1870 and June 1872—surely the most dilatory serial ever published—was brought out in book-form, much condensed and improved, in 1874, and has since been republished in London, the United States, and many other countries. In June 1870 Redmond Barry made him clerk (afterwards secretary) to the trustees of the public library, and in 1873 he became sub-librarian; but such work was as alien to him as banking or reporting, and his time was really spent in literary composition of the most varied character, from psychology to pantomime. Spasmodic, improvident, worn out with constant living at high pressure, bitterly disappointed when on the librarian's death in 1880 he was not chosen to succeed to the post, and deeply wounded when in July 1881 the trustees requested his resignation on account of insolvency, Clarke died suddenly on 2 August in that year, technically of congestion of the liver.

The succession of events just narrated will convey an idea of Clarke's character. A brilliant writer and a fascinating comrade, he was so

essentially unstable that out of his crowded achievement only a single book has attained or deserves remembrance. Within 14 years he produced two novels, about 30 tales, a dozen comedies and burlesques, and many pamphlets, besides a considerable mass of journalistic work. Apart from *His Natural Life* (to use the abbreviated title by which the book is now known) and a few album verses, all these productions are practically valueless. The most notorious of them is a pamphlet, *The Future Australian Race*, published in 1877. He was entirely undisciplined. While writing for the *Argus*, he censured it violently in a rival newspaper; while secretary to the trustees of the library, he attacked a notable dignitary, Bishop Moorhouse, in the *Melbourne Review*. Yet his personality secured pardon for nearly all his vagaries. 'Sir Redmond Barry' wrote a high library official afterwards, 'and his fellow-trustees, and indeed most people who knew him, were very merciful to Marcus Clarke. Faults that would have gone far to ruin another man were overlooked in him.' Much admired, much beloved, but prodigal of his intellect as of his income, he left a name that Australians will be slow to forget. But he left also two legacies that have done Australia much harm—his preface to Gordon's *Poems*, which is a hopeless misreading of the bush, and his great but quite un-Australian novel, which depicts life in British prisons controlled by British officials, and has no more relation to ordinary colonial life than the diary of a governor of Dartmoor would have to the life of a Devonshire farmer.

Clarke, William Branwhite (1798-1878), born on 2 June 1798 at East Bergholt in Sussex, was educated at Dedham grammar school and Jesus College, Cambridge (B.A., 1821; M.A., 1824). At the university he attended the lectures of Professor Sedgwick and Dr. E. Clarke on geology, and acquired both an enthusiasm for and a considerable knowledge of the science; he also wrote verse of an undistinguished kind, being defeated by Macaulay in the competition for the Newdigate prize. In 1821 he took holy orders (priest, 1824), but did not settle down to parochial work, spending a great part of the next 18 years in travel through England and on the European continent and in scientific—mainly geological—investigation. In 1833 he was given the living of Longfleet in Dorset, and in 1837 became chaplain to the bishop of Salisbury. In 1839 he was advised to take a long sea voyage to restore his health; his decision to visit New South Wales was partly due to a wish to examine rock-structure in Australia. Arriving in Sydney, he was almost immediately appointed to the parish of Castle Hill and Dural, combining with it the nominal headmastership of The King's School at Parramatta—he had charge of the upper school, the lower school and boarding-house being left to J. Troughton, the former headmaster's brother-in-law. This arrangement, however, proved unsatisfactory, and at the end of 1840 Clarke resigned the headmastership, and was shortly afterwards transferred to parochial work at Campbelltown. In 1846 he became incumbent of St. Thomas's Church, North Sydney (then called Willoughby), and remained there till 1870.

His clerical work, however, while faithfully performed, was by no means his principal gift to Australia. As in Europe, so in Australia, his chief interest was science, especially geology. It is with the discovery of gold that his name is mainly associated in the popular mind; he is not actually the first discoverer—McBrien in 1823 had found some in the Fish River valley, and Strzelecki in 1839 found traces in the Vale of Clwydd—but his explorations were more persistent, and decisive of the fact that the precious metal existed in widespread deposits. Ignorant of previous discoveries, Clarke in 1841 obtained gold from the head of the Cox valley, in 1842 found it on the Wollondilly, in 1844 north of the Liverpool Range, and in 1845 in several places in the Bathurst district. But, as the convict population of New South Wales was still large and must not be abnormally excited, Governor Gipps prevented the discoverer from proclaiming his news. When the existence of gold was made public, Clarke of course set to work with renewed interest: he suggested that a field probably existed in Victoria, somewhere between 143° and 145° E. long. on or near 37° S. lat.—Hiscock on the hint found gold at Buninyong, and so led up to the great find at Ballarat; he also suggested possible fields in New Zealand, and so stimulated prospectors to work there. In 1851, having been commissioned by the government to make a survey of southern New South Wales 'with a special view to the indications of gold,' he spent nine exhausting months on the Monaro, round Kosciusko, and on the upper Murray, without much result as far as gold was concerned. For his work then and previously he was awarded at different times £6000 by colonial governments. Nor was gold the only object of his research. In 1877 he received the Murchison medal of the London Geological Society for his work on the New South Wales coal-fields; and as early as 1849 he discovered the existence of deposits of tin.

The date of his appointment to the secretaryship of the Australian Museum is still in doubt. George Bennett, his predecessor, resigned the post on 1 February 1841, and Clarke's formal appointment as 'secretary and curator with salary' dates from 6 July of that year; but the Museum minute-book contains an entry showing him as secretary on 2 January 1839. He retired from this office in 1845. He was a member of the council of the Australian Philosophical Society when it was resuscitated in 1850; its vice-president when in 1856 it became the Philosophical Society of New South Wales; and one of its two permanent vice-presidents when in 1866 it was again transformed to the Royal Society of New South Wales. (The governor for the time being was always president, so that Clarke's position was the highest attainable.) He was to the last an exceedingly active member, and the titles of his papers range from 'Deep Sea Soundings' to 'The Effect of Forest Vegetation on Climate.' He was at all times a busy writer, though his only books are the *Researches in the Southern Goldfields of New South Wales* that narrated his journey of 1851, and the *Remarks on the Sedimentary Formations of New South Wales*, the fourth edition of which he completed a fortnight before his death. In 1876 he was made a fellow of the Royal Society, for his work on gold discoveries, at a time when that honour was very rarely conferred for work in Australia. After 1870, when he retired from clerical work, he devoted himself entirely to science, and died on 17 June 1878, the acknowledged leader of scientific thought in Australia. After his death the government bought his collection of fossils for £7000.

Clematis, a large genus of the family Ranunculaceae, consisting of climbing plants,

widely dispersed over temperate regions. Five species are endemic in Australia. The plants climb by means of leaf-stalks, which coil over the branches of trees; the cream-coloured unisexual flowers are borne in large trusses, the sexes on distinct plants; the petals are obsolete, being represented by coloured calyx-lobes; the fruits are terminated by the persistent base of the style, which is plumed and curved like an ostrich-feather. *C. aristata* and *C. glycinoides* are coastal species, the former ranging from Western Australia to Queensland, the latter not extending westward beyond Victoria. *C. microphylla* is found on the coast and inland in all the States. The coastal species are somewhat indiscriminately known by various names that properly belong to English species of clematis —'traveller's joy,' 'virgin's bower,' and 'old man's beard.'

Clerodendron, a genus of the family Verbenaceae, consisting of trees, shrubs (rarely herbs), and woody climbers. It is mainly tropical in habitat, largely Asiatic, with a few African and American species. Several species indigenous to Australia are ornamental shrubs with large white (or cream-coloured) fragrant flowers. The calyx is enlarged and persistent; corolla-tube slender, 5-lobed; stamens protruding, occasionally thread-like; fruit more or less succulent, separating into 4 nuts; leaves opposite or in whorls. *C. inerme,* a species found in north-eastern Australia, also occurs in India, where they extract an exquisite perfume from the flowers. The succulent leaves are bitter,

Sturt's Desert Pea (*Clianthus Dampieri*).

and yield a quantity of mucilaginous juice with a slightly saline but intensely bitter taste, sometimes used as a febrifuge. *C. tomentosum* is frequently found near tidal waters. It has a soft, porous wood of a bright yellow colour.

Clianthus, a genus of the family Leguminosae, containing two species, one endemic in Australia, the other limited to New Zealand. *C. Dampieri* (Sturt's Desert Pea), found in the interior of Australia, is a prostrate herb covered with a dense vestiture of long greyish silky hairs. The magnificent scarlet blooms, with a glossy purplish disk on the upper petal (standard), are arranged in a drooping cluster of several flowers at the top of the stem. This plant, being hard to raise, is not commonly seen in gardens; the excessively hard coating of the seed has to be softened by a thorough soaking before germination can take place. The New Zealand *C. puniceus* is an ornamental shrub, bearing red or white flowers.

Clifton, MARSHALL WALKER (1787-1861), born 1 November 1787, was the son of F. Clifton, prebendary of Lincoln, and a scion of the Cliftons of Clifton in Nottingham. For some years secretary to the royal navy victualling board, he afterwards became chief commissioner of the company that promoted the settlement at Australind (q.v.). He settled there in 1841, devoted his efforts to the prosperity of the settlement, and died there in 1861. J.S.B.

Climate. See METEOROLOGY AND CLIMATE.

Close, EDWARD CHARLES (1790-1866), born at Rangamati near Calcutta on 12 March 1790 and educated at Ipswich in Suffolk with a view to taking holy orders, in 1808 abandoned the Church for the army (ensign, 1808; lieutenant, 1809), serving in the Peninsula and taking part in the battles of Talavera, Busaco, Albuera, Vitoria, the Nivelle, Orthes, and Toulouse. In 1817 he came with his regiment (the 48th) to New South Wales, and in 1821 was acting engineer at Newcastle, but at the end of that year seems to have resigned his commission and settled down as a landowner at Green Hills, now the town of Morpeth; to the 2000 acres he held there he soon added another 3800, thus becoming one of the biggest landholders in the Newcastle district. The Green Hills property, lying along the ridge at the head of the Hunter navigation, was the obvious site for a township; but Darling's attempts to recover the grant without giving Close an equal area elsewhere delayed resumption until the impatient settlers had planted themselves on the low land of West Maitland, and Close's later subdivision of his Green Hills land did not attract them back. Made a magistrate in 1822, he was in 1827 involved in the trouble over the shooting of aborigines on Dr. Bowman's land (for which see LOWE, NATHANIEL) and removed by Darling from the magistracy; he was not, however, long in disfavour, being appointed on 1 February 1829 an original member of the newly constituted legislative council. From this position he retired in 1839, and lived quietly on his estates until his death on 7 May 1866.

Clover-fern. See NARDOO.

Clover-root. See GEUM.

Club-mosses. See LYCOPODIALES.

Coachwhip-birds (*Psophodes*), a genus of terrestrial, scrub-haunting birds peculiar to Australia. Coachwhip-birds are among the anomalous perching birds (Passeriformes) of the continent,

and their relationship to other forms is quite uncertain. By Gould they were placed with the lyre-birds (Menuridae) and more recent authors have regarded them as Timaliidae.

The common Coachwhip-bird (*P. olivaceus*) occurs in suitable country all along the east coast from northern Queensland to eastern Victoria. Concealed among the dense vegetation, it is far more often heard than seen. Its calls consist of a series of loud musical notes ending

Coachwhip-bird.

in a crack like that of a whip. Usually the crack is immediately followed by two notes sounding like 'twit-twit,' regarding whose source there has been much discussion. It is now certain that they are usually uttered by the other bird of the pair; one bird, however, may sometimes be responsible for the whole performance. By gradually approaching the spot whence the calls are uttered, and then remaining quiet for some time, it is generally possible to see one or more of the birds. They are about the size of thrushes, in colouring a very dark bronzy-green, with black heads and white patches on the cheek and in the centre of the breast; the head bears a bushy black crest. They feed on the ground, scratching up leaves and turning over small stones with their powerful feet, and at intervals repeating their call. Sometimes they elevate their crests and spread their long broad tails, or chase one another through the vegetation and round or over fallen logs. The nest, an open cup-shaped structure of twigs, fibres, and rootlets, is built in a bush surrounded by thick scrub. The eggs, two or three in number, are pale blue with black spots and lighter scrawls.

The only other species of the genus is the Black-throated Coachwhip-bird (*P. nigrogularis*) of south-western Australia. This species differs remarkably from its eastern relative in habits and song; it frequents tea-tree thickets among the coastal sandhills, and utters a peculiar, harsh, grating song. It does not appear to have been met with for many years past, and is probably extinct.

W.B.A.

Coachwood, the vernacular name of *Ceratopetalum apetalum*, a tall (50-100 feet) and highly ornamental tree with a smooth bark and harsh toothed leaves 3-6 inches long, growing in mountain gullies. The calyx, at first small, enlarges and reddens when the fruiting season arrives; as the petals are obsolete, this coloured calyx—as with the Christmas Bush (q.v.)—is

Coachwood.

popularly supposed to be the flower. The timber is valuable, but not obtainable in quantity, as the tree usually chooses an almost inaccessible habitat; it is largely used in coach-building, especially for the frames, where it is considered equal to English ash. Owing to the presence of coumarin in the sap, the bark when wounded gives off an odour like that of the Tonkin bean. See CERATOPETALUM.

Coal. The principal and the first-discovered coal-fields in Australia are those of New South Wales; they are for convenience' sake classified as northern, southern, and western, but form a single continuous basin comprising three series of payable seams. The upper (Newcastle) series, which outcrops at Newcastle in the north, Bulli in the south, and Lithgow in the west, for many years provided the main supply of coal. The middle (Tomago) series is worked chiefly in the Maitland area. The lowest (Greta) series, unknown 40 years ago, has of late years become the most important in Australia.

The first discovery of coal in Australia was made by chance and not thought worth following up. In June 1796 fishermen brought pieces of coal to Sydney from 'a bay near Port Stephens,' where they said there was a good deal more lying on the surface. Again in May 1797 a party of seamen from the wrecked *Sydney Cove*, during their overland journey from the Ninety-mile Beach in Victoria to the settlement on Port Jackson, found lumps of coal on the beach at Coalcliff (now Clifton) a few miles north of Bulli, and their discovery was confirmed later in the year by George Bass. But the locality was difficult of access, and the seam was neglected in favour of the northern field, which was discovered in September of the same year by Lieutenant Shortland at the mouth of the Hunter River. Owing to the lack of small craft to fetch the coal to Sydney, and also to the fear of a mutiny of convicts at sea, the governor took no steps to work this field; but private merchants were permitted to collect small cargoes, some of which were shipped to India towards the end of 1799—this being the first export of coal from the colony. A cargo was also collected from the shores of Lake Macquarie, in August 1800. Governor King, on his arrival, set the only expert miner in the colony (a convict with a life sentence) to search for the mineral in the neighbourhood of Sydney; being unsuccessful in this, and having been ordered by the colonial

office to send coal to the Cape of Good Hope, he despatched an expedition under Colonel Paterson to the Hunter River in June 1801, and, receiving a favourable report, established there a small penal settlement to procure coal and timber. He also issued on 3 July 1801 an order declaring the coal and timber of the Hunter River district to be the exclusive property of the crown and ordaining that persons engaged in the coal trade must be licensed. Coal was now obtained for colonial use, several cargoes were sent to India, and in November 1801 a first shipment was made to the Cape. Owing to administrative difficulties King in 1802 closed the establishment, but it was reopened in March 1804 under the name of Newcastle. The government monopoly then declared was maintained until 1831, when the mines were taken over by the Australian Agricultural Company (q.v.).

When Commissioner Bigge visited Newcastle in 1820 only 27 convicts were employed in raising coal, and a little later the whole revenue derived from the industry was £500 a year: Bigge therefore recommended that the mines should be leased for a term of years, an annual rent and a proportion of the coal won being reserved for the crown. The colonial office willingly opened negotiations with the Australian Agricultural Company, which sent a manager and some plant to New South Wales; but Governor Darling was against the change and refused to transfer the mines without direct orders from home, and the company's local advisory committee disliked the proposal, so the manager had to go back to England. However on 6 August 1828 Darling was definitely ordered to transfer to the company two blocks (one of 1500 acres, one of 500) in the Hunter River district, and to cease operations in the government mine as soon as the company was ready to take over control; but if the company did not in any one year raise a certain specified quantity of coal the colonial government could resume the mines. A quit rent was to be paid, and coal enough for the government's own requirements would be delivered at the pit-head at prime cost. For 31 years no governor, without the previous sanction of the colonial office, was to grant or convey any local mines or land containing coal without a specific exception of the coal, or to assign convict labour for coal-mining. In 1831 the company took over the mines, and to avoid competition not only bought up land at Newcastle but protested against an application made in 1838, and supported by the governor, to work coal at Western Port, and a second application in 1839 by Captain Westmacott to open up the Bulli field. The crown law officers, however, refused to admit that the company had a monopoly, and there was no official interference with the southern enterprise, which nevertheless proved abortive. There was no active competition in the industry until in 1845 James Brown opened a pit at Four-mile Creek near East Maitland on 60 acres of land originally granted to Colonel Dumaresq. Proceedings were initiated against Brown, but while the case was on appeal information was received in Sydney that the company had agreed to terminate the alleged monopoly. In 1850 the governor cancelled the reservation of coal made in all grants theretofore issued, and the Australian Agricultural Company had to face increasing competition. Of late years the centre of the northern coal-field has shifted from the Newcastle to the Maitland district, the great wealth of which was first recognized when in 1886 Edgeworth David (q.v.) located an outcropping coal seam in a creek near Abermain, and traced it to Cessnock. Early in 1889 a syndicate acquired 250 acres in this new field, and in 1891 the East-Greta Coal-mining Company was formed. The Greta coal-measures are worked under an area extending from Cessnock north to Muswellbrook; their coal is very hard and of excellent quality for gas-making and household purposes, but makes too much black smoke for use by warships. Its seams are of exceptional thickness, some ranging as high as 32 feet, and in the Stanford-Merthyr colliery first-class coal is worked 22 feet in thickness without a band. The Greta series also appears at the southern end of the coal area, on the Clyde River, but its coal there is of inferior quality.

The southern (Bulli) field, though first discovered, was not opened up until 1857 owing to the difficulty of reaching it, Illawarra being accessible from Sydney only by sea or down the steep sides of the coastal range. In 1857, however, the Mount Keira pit was worked, the output for May of that year being 142¾ tons. In 1858 the Bellambi colliery was opened, the coal being taken in carts to the beach and there put aboard small colliers lying off the unsheltered coast. Developmental work at Bulli followed, and in 1862 the South Bulli pit was opened. Transport facilities were gradually improved, jetties being run out either wherever a curving beach provided shelter from southerly gales or—as at Clifton, north of Bulli—straight from the pit-mouth in the side of a cliff. In 1901 harbour improvements at Port Kembla, south of Wollongong, made transport from the southern collieries much safer and easier. The two worst disasters in the history of Australian mining occurred in southern pits—at Bulli on 23 March 1887, when 81 persons were killed, and at Mount Kembla on 31 July 1902, when 95 were killed. Bulli coal is a good steam-coal, frequently used by Australian warships, being more nearly smokeless than any other coal in Australia that is produced on a commercial scale.

In the western coal-field, between the Blue Mountain spur and the main dividing range, mining began during the late sixties, the Hartley measures being opened up by Saywell and Grand at Bowenfels, by Woolley and Anderson and by Thomas Brown in the Lithgow valley, and by Andrew Brown at Cooerwull. In 1869 the output was 1360 tons, of late years it has averaged 1¼ million tons. It is essentially a steam coal, but inferior to the southern coal. In 1916 the New South Wales government opened a State coal-mine at Lithgow.

In 1847 W. B. Clarke asserted that workable seams of coal would be found to occur under Sydney, and later geologists pointed out that the northern, southern, and western measures were part of one vast, continuous geologic basin. Boring carried out towards the end of last century proved the existence of coal under the city, and in 1903 the Sydney Harbour Collieries Company was formed to work the seam from a shaft at Balmain. After many vicissitudes the mine, which has a depth of 2784 feet, was temporarily abandoned in 1917.

A few scattered fields of minor value also occur in outlying parts of New South Wales. In 1915 sub-bituminous black-coal measures were found to underlie an area of about 23,000 acres in the Riverina district. These deposits have associated with them a large overburden of kaolin of high quality, the profits from which it is hoped will go towards meeting the cost of

mining. A company has been formed to work this deposit, and a shaft has been sunk at Coorabin; but no serious attempt has been made to utilize the lignite deposits which occur in various localities, or the Triassic coal-measures of the Clarence and Richmond River districts, which are intersected by bands and contain a large percentage of ash. The yield in the three main fields of New South Wales for 1922 (the latest year for which detailed statistics are available) was: northern, 7,156,921 tons, southern, 1,878,594 tons, western, 1,147,618 tons, making the total for New South Wales 10,183,133 tons, the Australian output for the same year being 12,208,617 tons. The New South Wales total for 1924 was 11,618,216 tons.

Certain seams in each of the three areas produce good coking coal. The best comes from the Bulli seam; it is exceedingly strong and specially suitable for smelting purposes, by reason of its capacity for sustaining the weight of the ore burden in the blast furnace. It has a specific gravity of 1.88 to 1.9, whereas that of western district coke rarely exceeds 1.8, and northern coke may go as low as 1.72.

Queensland.—The coal resources of this State, which are still comparatively untapped, are of vast extent and wide distribution. The southern field (Ipswich-Darling Downs) was first worked, and is still the centre of the most extensive operations, chiefly because of the facilities for export. In 1843 John Williams opened a pit on the south bank of the Brisbane River to meet the requirements of the Hunter River Steam Navigation Company, which was then running steamers to the northern settlement; by 1851 Williams was prepared to deliver supplies to residents of Brisbane. At a later date collieries were opened north and south of the Bremer River to work the bituminous Ipswich seams, and others farther west on the Darling Downs, where cannel coal occurs. In the Wide Bay district seams have been worked since the seventies, the Burrum mines being the most productive. The Rockhampton district has extensive deposits of great variety and good quality. Near the Styx River the State is working excellent bituminous coal, the only deposit in the central district that is suitable for gas-making purposes; it is of a natural coking variety. In 1891 a party of gold prospectors found a 30-ft. seam free of bands on the Callide Creek, a tributary of the Dawson, but it was not until 1901 that large and valuable seams of anthracitic and semi-anthracitic coal were found to underlie the area between the Mackenzie and Dawson rivers. Two collieries near Baralaba on the Dawson River line are now being worked, one by the State and the other by the Mount Morgan Gold-mining Company; this coal contains up to 86 per cent of fixed carbon and only 4 or 5 per cent of ash. Extensive seams of hard, clean, bituminous, non-coking coal (with 60 per cent fixed carbon, 28 per cent volatile hydrocarbon, and 5 or 6 per cent ash) occur round Clermont; this coal was first found at Blair Athol in 1864 during the sinking of a well. Bores were put down by the Peak Downs Copper Mining Company, which required coal for copper-smelting, and worked the seam until 1879. In 1886 there were further developments, and the field was surveyed in 1889. It is only within the last decade, however, that the value of the deposits has been recognized. Edgeworth David has estimated the coal in the field to aggregate 258,000,000 tons; the maximum thickness of the seams so far ascertained is 93 feet.

In the north the Bowen coal strata were early recognized, and more importance was attached to them than subsequent discoveries warrant. Meanwhile the name 'Bowen River beds' had been extended to cover wide areas where the formation is geologically identical with these earlier-known strata. Since 1919 the State has worked a mine in the Bowen field. In the Cook district the beds cover more than a thousand square miles: the Little River field near Cooktown was examined in 1882, but the only deposits actively worked are at Mount Mulligan, from which coal is obtained for the State smelters at Chillagoe. The only true anthracite in Queensland occurs at Mount Bopple near Maryborough, where a small seam of anthracite and one of graphite are separated by a few inches of baked shale. At Waterpark Creek, between Rockhampton and Mackay, there are large and neglected deposits of brown coal.

The Queensland fields, therefore, are for the most part still undeveloped. The yield in the chief mining centres in 1922 was:—

Ipswich	579,484 tons
Darling Downs	93,524 „
Wide Bay	79,305 „
Central (Rockhampton) ..	68,075 „
Clermont	104,141 „
Bowen	11,506 „
Mount Mulligan	22,484 „

In 1922 the total output was 958,519 tons. But the actual reserve of coal, according to the government geologist, is 412 million tons, and the probable reserve 2201 million tons.

Victoria.—In this State coal was first discovered in 1825, near Cape Paterson, but no attempt was made to work it until the Port Phillip settlement was officially established in 1838. In June of that year Governor Gipps forwarded to the colonial office an application from some Tasmanians for leave to open coalmines on Western Port in order to supply the increasing demand for coal across the strait. Little came of the application. Between 1838 and 1873 unsuccessful attempts were made to work the coal, and the colonial government spent considerable sums in assisting boring operations in different localities on the recommendation of private individuals. In 1873 an expert from New South Wales was invited to report on the field in the neighbourhood of Cape Paterson. In his report, which was very unfavourable, the expert pointed out that these seams were of later formation than the coal-measures of New South Wales; he saw no reason to hope that seams of any thickness or persistence would be found in the district. Interest thereupon flagged. But as a result of discoveries made from 1878 onward in the Hazelwood Range, at Mirboo and in other localities in southern Gippsland, the government agreed to assist boring operations there, and after 1889 (up to which date the total production in the colony was only 25,000 tons), the industry was somewhat stimulated, the Coal Creek Company at Korumburra being registered in that year, the Jumbunna Company in the following year and the Outtrim, Howitt, and British Consolidated in 1894. In 1908 an extensive field was discovered in the Powlett River district, the seam being of good, clean, hard coal averaging six feet in thickness. The government decided to work the field itself, and in 1909 the establishment of a state coal-

mine was legalized. Operations were begun towards the end of the year, and a township, Wonthaggi, was laid out on modern lines. The production of black coal in Victoria in 1922 was 559,284 tons, of which 511,174 tons were produced by the state mine.

In addition to its deposits of black coal, all of which occur in the southern Gippsland district, Victoria possesses extensive fields of brown coal and lignite. Little effort was made to utilize these until 1917, when an advisory committee recommended the establishment of an open-cut mine at Morwell for the development of a scheme of electric power generation. For details of subsequent work on this field see MORWELL. In 1922 90,402 tons of brown coal were produced.

Western Australia.—In March 1839 the government of the Swan River colony offered 2560 acres in fee simple to any person who discovered any considerable bed of coal; the offer was repeated several times, but, although sporadic efforts were made to work coal near the Murray River, in the Irwin district, on the Phillips River (near Albany), and at Fly Brook (the south-eastern tributary of the Donnelly River), no field of commercial value was found until 1889, when a carboniferous formation noted in the Collie district by a local farmer was proved to be true coal. A company was formed, but was obliged to abandon work for lack of capital. After a favourable report by an expert from New South Wales the government undertook a series of borings which proved the existence of a field about 50 square miles in extent with seams of a total thickness of about 137 feet; the Collie railway was then built, and operations begun on a commercial scale. Collie coal is non-coking, semi-bituminous, and singularly deficient in volatile materials: it occurs in two distinct types, one characterized by low moisture and sulphur and oxygen contents and high ash and carbon content, the other exactly opposite in character (high moisture, low ash, etc.). Coal has been found at several other places in the south-west, and a 12-foot seam has been discovered in the valley of the Fitzroy River in the far north: but no commercial use has been made of any of these finds. The output of the Collie mines in 1922 was 438,443 tons.

Tasmania.—In 1803 coal was found at the head of the Coal River, near Lake Tiberias, but was not worked. John Busby (q.v.), who visited Tasmania on his way to Sydney in 1824, reported favourably on both this seam and one discovered on Schouten Island, and in 1826 equally good reports were made on deposits at South Cape Bay and on the western shores of D'Entrecasteaux Channel; but the high cost of mining and transport prevented further development of these seams, although the Coal River deposits were worked intermittently. There was also a mine, worked by convicts for the use of the penal settlement at Port Arthur, on Tasman Peninsula. Strzelecki in 1842 reported on seven Tasmanian seams, but only the upper Coal River seams (Jerusalem and Jericho) were praised; in 1850 coal was discovered on the Mersey River, but the industry remained at a standstill until in 1855 excellent seams were opened up in the Fingal district on the eastern coast. In 1922 the Tasmanian coal-yield was 69,238 tons, over 90 per cent of it coming from the Fingal mines of the Mount Nicholas field. The island also possesses beds of lignite and brown coal, but these have not been exploited.

South Australia.—In this State there is no active coal-mining. Bituminous seams have been found near Robe in the south-east, Kuntha Hill on the Barcoo, and Lake Phillipson in the far west, north of Tarcoola; a sub-bituminous deposit is known at Leigh Creek, east of Lake Torrens; brown coal has also been found, and lignites are widely distributed.

The total amount of Australian coal (exclusive of bunker coal) exported to other countries in 1922-3 was 1,114,115, practically all from New South Wales. The principal ports of destination were New Zealand (394,701 tons); Philippine Islands (139,194 tons); United States (123,504 tons); Chile (107,351 tons); India (104,013 tons); Netherlands East Indies (73,170 tons); Hawaiian Islands (54,706 tons); Straits Settlements (43,967 tons). In 1922 there were 27,057 persons employed in coal-mining in Australia; the average death-rate from accident during the quinquennium 1918-22 was 1.57 per 1000 miners.

An excellent discussion of the coal resources of Australia will be found in the *Report to the World Power Conference* of 1924 made by the Australian Institution of Engineers.

Coast Rosemary. See LABIATAE.

Cobalt. See MINERALOGY.

Cobb and Co. See RUTHERFORD, JAMES.

Cobbler. See FORTESQUE.

Cobbler's Pegs. See COMPOSITAE.

Cobra. See MOLLUSCA.

Coccidae, insects of the sub-order Homoptera and order Hemiptera, often called scale-insects, gall-lice, or mealy-bugs. They are very abundant in Australia, more than 300 species having been described, most of which are so remarkable that they deserve special notice—interested readers should consult the works of Maskell, Schrader, Fuller, and Froggatt. Most Australian plant-galls are caused by coccids of the sub-family Apiomorphinae, usually known as 'brachyscelid' galls from the original but pre-occupied name of the genus. Many of these galls are of huge size and bizarre form, e.g. the huge bifurcate gall formed by *Apiomorpha duplex* on branches of trees. In the Monophlebinae are included many large species of 'mealy-bug;' *Monoph'ebus crawfordi* measures up to an inch in length. In the genus *Callipappus* the females are large 'mealy-bugs,' while the males are beautiful insects known as bird-of-paradise flies, their delicate tail-threads resembling spun glass; the best-known Australian species is *C. australis* (plate xix, fig. 11). Australia has also numerous species of the true scale-insects—small insects, the mature males with two wings and the females wingless, which, owing to their habit of constructing scale-like matter beneath which they live, are readily transported on nursery plants or cuttings. The San Jose Scale (*Aspidiotus perniciosus*) has done more damage and caused more alarm to fruit-growers than any other insect. A few years after its introduction into the United States, it caused the death of various fruit-trees—especially apples and stone-fruit—over thousands of acres. Restrictive legislation was passed, expeditions to obtain parasitic checks were sent out, and useful natural enemies to it were found in its native home, China. In Australia it is kept well under control by its natural enemies, ladybirds of the genera *Rhizobius* and *Scymnus*.

Only one Australian scale-insect has proved

troublesome; but this species, the Cottony-cushion or Fluted-scale (*Icerya purchasi*), is exceptionally dangerous, as in 1906 it was reported to have threatened the extinction of the orange-growing industry in California. Only after the failure of mechanical remedies was the introduction of an Australian ladybird (*Novius cardinalis*) found effectual. This ladybird has also been effectively introduced into the orchards of South Africa, Italy, and elsewhere, as the enemy of *Icerya*. In Australia this scale is not a serious pest to fruit-trees, but attacks other trees, especially acacias.

Several indigenous species of *Kriococcus* are widely distributed in Australia, and are often dense on eucalypts and other native plants. *E. eucalypti* was accidentally introduced into New Zealand, where it damaged eucalyptus plantations till the introduction of one of its natural enemies (*Rhizobius ventralis*) kept it in check. The same ladybird has been useful in America. The Saltbush-scale (*Pulvinaria maskelli*) in some years greatly reduced the sheep-carrying power of land by the serious damage it did to saltbush in large areas of New South Wales, South, and Western Australia. *Frenchia casuarinae* causes galls on she-oaks, and often kills the branches; it is abundant in New South Wales, Victoria, and Tasmania; but the male has yet to be found.

Many cosmopolitan species have been introduced into Australia, causing annual losses of thousands of pounds. Among them are various species of *Dactylopius* (mealy-bug); one is a serious pest on the sugar-cane, another attacks pine-apples, a third is found at the roots of potatoes and other plants, and few plant-houses are free from the attacks of *D. adonidum*. The ladybird *Cryptolaemus montrouzieri* may often be seen feeding on mealy-bugs, and has been introduced into Hawaii in order to get rid of them; a good deal of success has been obtained. The Mussel-scale of the apple (*Mytilaspis pomorum*) injures trees and disfigures fruit in Tasmania and the cooler parts of Australia. Fumigation is almost useless as a remedy, since the eggs are laid beneath a covering scale; nevertheless fumigation on a vast scale is practised on Tasmanian apples before being permitted to enter mainland ports. The Mussel-scale of citrus fruits (*M. citricola*) affects the coastal regions of eastern Australia, and a few other species of the genus are frequently seen in plant-houses. The Red-scale of the orange (*Aspidiotus aurantii*) is a serious and widespread pest that is combated by fumigation with hydrocyanic acid gas and by oil emulsion sprays, or, at worst, by destroying affected trees. *A. rapax* (black), *A. rossi* (purple), and *A. ficus* are also very troublesome.

The Rose-scale (*Diaspis rosae*) sometimes encrusts the stems of the rose, blackberry, and raspberry, giving the appearance of white-wash. The Indian Wax-scales (*Ceroplastes ceriferus* and *C. rubens*) are very common in New South Wales and Queensland, where they have extended their attacks to such native plants as *Bursaria spinosa* and the bracken fern. Another abundant pest is the black or brown *Lecanium oleae*, that amongst other plants especially attacks the lemon, olive, and oleander; an allied species, *L. hesperidum*, selects the orange. In Western Australia the large Vine-scale (*L. berberidis*) has been troublesome, but is now largely kept down by chalcid parasites. See HEMIPTERA.

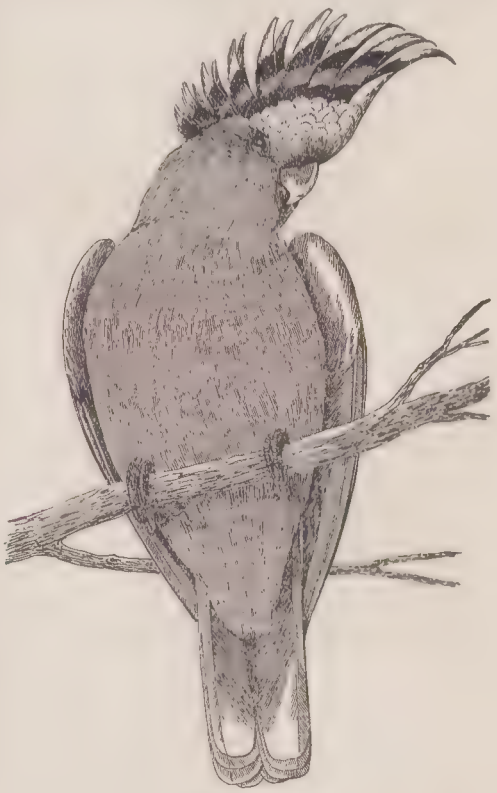
R.J.T.

Cockatiel. See PARROTS.

Cockatoo Bush. See MYOPORUM.

Cockatoos, large arboreal birds, with strong hooked beaks, feet with two toes turned each way, erectile crests and comparatively short tails, belonging to the family Cacatuidae and the order Psittaciformes (parrots).

Cockatoos are confined to the Australian region, extending from Tasmania through Australia, New Guinea, and the Moluccas to the Philippines, Celebes, and Lombok. In Australia and Tasmania 11 species occur, by far the best-known being the Sulphur-crested White Cockatoo (*Cacatua galerita*) found in New Guinea, northern and eastern Australia, and Tasmania. The most beautiful is the 'Major Mitchell' or Pink Cockatoo (*C. leadbeateri*) which is found inland. The Galah or Rose-breasted Cockatoo (*C. roseicapilla*) is another inland form plentiful almost throughout Australia, and the Bare-eyed Cockatoo (*C. sanguinea*) is abundant in the northern and



Pink Cockatoo.

central regions of the continent. The Corella or Long-billed Cockatoo (*C. tenuirostris*) was at one time common both in south-eastern and south-western Australia, but has now become very scarce, and seems to be approaching extinction.

The species mentioned are all very noisy birds; they associate in large flocks, and feed chiefly on roots, bulbs, and seeds—which they obtain on the ground, digging up the roots with their beaks. They are intelligent and wary; when a flock is feeding, sentinels are generally posted in neighbouring trees to give warning of the approach of danger. They nest in holes in trees (occasionally in cliffs), and

lay white eggs. In captivity they live to a great age, instances of birds living to 80 or even 100 years being not infrequent; and individuals possess an imitative faculty that enables them to learn and speak long sentences.

Black cockatoos—which constitute a separate section of the family—are more arboreal than their white relatives; they have very stout bills, by the aid of which they split open the woody capsules of eucalypts and the hard wooden fruits of proteaceous trees. They also tear off bark, and feed on the large wood-boring insect-larvae thus revealed. The largest of the black cockatoos is the Palm Cockatoo (*Probosciger aterrimus*) found in the Aru Islands, New Guinea, and northern Queensland; the most widespread is the Banksian or Red-tailed Cockatoo (*Calyptorhynchus banksi*), found throughout the continent, especially far inland; the most familiar —to most Australians—are the Funereal Cockatoo (*C. funereus*) of the south-east and Tasmania, and the White-tailed Cockatoo (*C. baudini*) of the south-west. Black cockatoos are shy birds and, owing to the difficulty of feeding them, are hardly ever seen in cages.

Funereal Cockatoo.

The smallest cockatoo is the Gang-gang (*Callocephalon fimbriatum*) of south-eastern Australia and Tasmania, where it lives in pairs in thick forest country. It is a grey bird, with a curious loose crest; the plumage of the female is entirely grey, but the male has head and crest scarlet.

W.B.A.

Cockburn, Sir John Alexander, was born on 23 August 1850 at Corsbie in Berwickshire, educated at Highgate and King's College, London (M.D., 1874; fellow), and in 1875 migrated to South Australia, settling at Jamestown as a medical practitioner. In April 1884 he was returned for Burra to the legislative assembly, and was minister for education in the Downer ministry (1885-7), founding during his period of administration the school of mines and industries. In April 1887 he was returned for Mount Barker, and held this seat until his retirement from politics in 1898. In June 1889 he became premier, and passed important acts dealing with succession duties and a progressive tax on unimproved-land-values. Defeated in August 1890, in June 1893 he joined the Kingston ministry as minister for education and agriculture, and from 1898 to 1901 was agent-general for South Australia in London. Keenly interested in federation, he represented his colony at the conferences of 1890, 1891, and 1897-8, devoting special attention to the advocacy of woman suffrage and 'one man one vote.' Since 1898 he has been a permanent resident of London. He severed his official connection with South Australia in 1901, but has maintained touch with Australia partly by acting as South Australian or Commonwealth representative at various international congresses and by presiding over the Australian chamber of commerce in London, partly by his many writings for the British press on Australian subjects. In 1901 he published a small volume of essays on Australian federation. (K.C.M.G., 1900.)

Gang-gang.

Cockle. Sir James (1819-1895), born on 14 January 1819 and educated at Charterhouse and Trinity College, Cambridge (B.A., 1842; M.A., 1845), studied for the law, was called to the bar in 1846, and made himself so good a reputation that at the instance of Chief Justice Erle he was appointed first chief justice of Queensland. This position he held from 1863 to 1879, when he returned to England, and

died on 29 January 1895. His legal attainments were of a high order, and only two of his judgments were ever reversed on appeal; he also left his mark as senior commissioner on the consolidation of Queensland statute law. His favourite science was mathematics; he was the author of upwards of 80 papers, most of them dealing with pure mathematics, and made important contributions to the theory of equations, especially differential equations. He was elected a fellow of the Royal Society in 1865, while in Queensland, and after his return to England he became a most active member of the London Mathematical Society, serving on its council from 1881 to 1890 and being president in 1886-8. During his residence in Queensland he was president of the Queensland Philosophical Society, which afterwards became the Royal Society of Queensland. (Kt. Bach., 1869.)

Cockspur. See CUDRANIA.

Cod. The family of Gadidae, so important in the fisheries of the northern hemisphere, is represented in Australia by a few species restricted to the colder waters of the south. The Red Cod (*Physiculus barbatus*), the best-known, occurs in considerable quantities on the Tasmanian and Victorian coasts, and ranges northwards to New South Wales waters during the colder months. It is an important food-fish in the southern markets. The so-called Ling or Beardie (*Lotella callarias*) is an allied species occurring on the south and south-eastern coast-line; it does not command much favour as a food-fish. Several species of other genera taken in deep water by trawlers are rather more closely allied to the true cod (*Gadus*) of the northern hemisphere, and may prove of commercial value, if they can be secured in sufficient quantity. The so-called 'rock cod' and 'Murray cod' are described under those names.

A.R.McC.

Ling or Beardie.

Cockroaches, insects of the family Blattidae, belonging to the order Orthoptera, were much more numerous in past ages, forming the dominant group in the insect faunas of the upper Carboniferous and Permian eras. They are still comparatively abundant in Australia, where about 47 genera and 270 species have been described. Sixty per cent of these species have the tegmina and wings functionless in both sexes, while a further 10 per cent have them functionless in the females only. This condition is of very great interest, and is correlated (as Dr. Eland Shaw has pointed out) with the gradual adoption of the habit of living in communities under rotten wood or in burrows in the soil. The wingless condition has evolved furthest in the *Polyzosteria* group of genera, the well-known 'black-beetles' of the bush, abundant everywhere; the best-known genera are *Polyzosteria*, *Cutilia*, *Platyzosteria*, and *Cosmozosteria*. *Polyzosteria mitchelli* (plate xix, fig. 1) is an exceptionally beautiful cockroach. Our largest native cockroaches are *Geoscapheus giganteus* and *Macropanesthia rhinocerus*, which attain a length of 2½ inches.

Among the winged forms, some handsome species hide under the bark of trees. *Methana marginalis* is a large, dark-brown cockroach with the tegmina strongly bordered with white on the costal area. Other common species belong to the genera *Panesthia*, *Escala*, *Ischnoptera*, and *Ellipsidion*. Species common in houses are the small *Blattella germanica* and the large *Periplaneta americana*, both introduced; the latter has almost completely replaced the original species, *P. australasiae*, in Australia. See ORTHOPTERA.

R.J.T.

Coelenterata, radially symmetrical, diploblastic (two-layered) animals. The most important members of this group are:—

Class Hydrozoa. Polyps and medusae with ectodermal gonads and no vertical partitions in the enteron; e.g. hydroid zoophytes (q.v.) and bluebottles (q.v.).

Class Scyphozoa. Medusae with endodermal gonads, and with a gullet and vertical partitions in the enteron of the polyp stage (when the latter exists); e.g. large jelly-fishes (q.v.), such as *Aurelia*.

Class Actinozoa. Polyps without a medusoid generation, and with endodermal gonads, a gullet, and vertical partitions in the enteron; e.g. sea-anemones (q.v.) and corals (q.v.).

E.A.B.

Coffee. In the warm north-eastern corner of New South Wales coffee succeeds well, but except on a very small scale has never been grown for market. In many coastal districts of Queensland it thrives to perfection, and about 1890 was planted to some extent; but in consequence of low prices and labour difficulties many plantations were abandoned. The maximum production was reached in 1901-2, when an area of 547 acres was recorded. In 1908 there were 285 acres under trees in bearing, which produced 116,293 lb. of (parchment) coffee. The chief producing districts were Cairns, Maroochy, Mackay, and Maryborough. After 1908 the cultivation gradually declined to 21 acres in 1922-23 (almost entirely in the Cairns dis-

trict) the quantity raised being 9368 lb. The quality of the coffee produced is good, and the trees grow well and yield prolific crops.

W.S.C.

Cole, GEORGE WARD (1793-1879), born on 15 November 1793 and entered as a volunteer in the navy in 1807, served through the rest of the French wars on the West Indies and North Sea stations, and was wounded at New Orleans in December 1814 while in command of a gunboat. In 1815 he was made a lieutenant, retired on half-pay in 1817, and in 1837 was gazetted commander. Between 1817 and 1839 he was engaged in the merchant service, and in 1840 settled in Victoria and helped to found the Port Phillip Steam Navigation Company. He also built the first private wharf on the Yarra, and the first screw steamship to be launched (on 20 February 1851) south of the equator. He took some interest in local politics, combining with Fawkner in 1848 to nullify the Port Phillip elections to the Sydney legislative council, and himself representing Gippsland in the Victorian council from 1853 to 1855. In 1859 he was elected by the central province to the new council, and held the seat till his death; from 1863 to 1868 he represented the first McCulloch ministry in the council, though holding no office. He died on 26 April 1879.

Coleoptera. See BEETLES.

Coles, SIR JENKIN (1842-1911), born in Sydney on 19 January 1842, taken by his parents to England in 1849, and educated at Christ's Hospital in London, returned to Sydney in 1858 and after a time settled in South Australia. For some years he served in the mounted police, then became an auctioneer, and in July 1875 was elected to the legislative assembly for the district of Light. From 1878 to 1881 he was out of parliament, but in 1881 was re-elected for Light, and retained the seat until 1902, when his constituency was merged in Wooroora, and he became member for that district. In the Colton ministry of 1884-5 he and Thomas Playford held alternately the commissionerships of crown lands and public works, and in Playford's ministry of 1887-9 Coles was commissioner of crown lands. From 1890 to 1911 he was speaker of the legislative assembly, but retired in November and died on 6 December 1911. (K.C.M.G., 1894.)

Collembola. See SPRING-TAILS.

Collins, DAVID (1756-1810), born at Exeter on 3 March 1756 and educated at the local grammar school, joined the marines—the Plymouth division of which his father then commanded—in 1770 (2nd lieutenant, 1771; 1st lieutenant, 1775; captain-lieutenant and captain, 1779; brevet lieutenant-colonel in army, 1798; brevet colonel in army, 1808), fought at Bunker's Hill, was made adjutant of the Chatham division at the end of 1776, and in 1782 served aboard H.M.S. *Courageux* at Lord Howe's relief of Gibraltar. Next year, at the peace, he was placed on half-pay, but in 1786 volunteered for service with the detachment of marines destined to accompany Phillip's expedition to New South Wales, and on 24 October was appointed deputy-judge-advocate on Phillip's staff. This appointment made him practically the head of the settlement's judicial system; he was president of the civil court with two nominees of the governor to assist him, and president of the criminal court with six naval or military officers to assist him. He had no special knowledge of law, but great industry and a considerable fund of commonsense fitted him for the work, and the precedents he established both in form and matter were respected (with a very few exceptions) until the establishment of a real supreme court in Macquarie's time. On 1 January 1787 he was appointed judge-advocate of the marines also. He held his first criminal court in Sydney on 11 February 1788 (three cases of assault and larceny among the convicts) and his first civil court on 1 July. In June Phillip made him also secretary to the governor, so that he was by far the most powerful man in the settlement next to Phillip himself; and from first to last his conduct was above suspicion, and Hunter in 1795 told the British authorities that he knew no individual in the colony 'whose absence would be so heavily felt by the public service . . . . if he were now impatient to quit the colony, I cou'd not, without exposing it to the most manifest injury, give my consent to his doing so.' In 1792 he had asked for leave of absence and had obtained it from England, but was detained for four years longer in New South Wales, 'because of the consequence which each successive commanding officer considered him of to these settlements.' The long delay injured him personally; after the departure of the marines for England in 1791 he lost his pay as judge-advocate of the detachment, his half-pay ceased because he was holding a civil appointment, and on his return to England (which he reached on 26 July 1797) he was informed that, owing to his long absence and detachment from marine duties, he could only return to active service as junior captain in the corps. Refusing this indignity, he was partially compensated by the grant of a brevet-colonelcy in the army. He now devoted himself to the preparation of a book describing the first 10 years of the colony's existence, about which more is said in another paragraph; this was published in 1798. Tired of a restful existence, on 10 September 1800 he suggested to Sullivan (under-secretary for war and the colonies) that he should be appointed to the department as a special officer in charge of New South Wales affairs; this suggestion passed unnoticed, probably because of the confusion then existing in British politics, and on 15 November 1801 he made a second attempt, with the aid of the Duke of Portland, to obtain either employment or compensation for his previous losses. It was possibly due to Portland's aid that, when towards the end of 1802 the colonial office decided to make a settlement on Port Phillip, Collins was chosen to lead the expedition, and on 14 January 1803 was commissioned 'Lieutenant Governor of a Settlement or Settlements to be formed on the Southern Coast of New South Wales to the northward of Basses Streights.' The story of his abortive attempt to settle on Port Phillip will be found under VICTORIA, and that of his successful settlement on Storm Bay in southern Tasmania under TASMANIA; here it may be said that he left England in H.M.S. *Calcutta* on 25 April 1803, reached Port Phillip on 9 October, abandoned it on 30 January 1804 (transporting his party in the *Ocean*), landed at Risdon Cove on 16 February, and almost immediately moved across the river to Sullivan's Cove, on which Hobart now stands. From this centre for six years he ruled with good judgment, but under an ever-increasing burden of difficulties, the southern half of the island. He was merely a deputy for the governor of New South Wales;

consequently his despatches to England were never acknowledged or commented on, he had practically no judicial mechanism (both criminal and civil suits being supposed to be tried in Sydney), his supply of convicts—the only source of labour—came from Sydney only and was scanty (Sydney had none too many for its own use), and his supply of provisions had the same origin and the same fatal defect. He obtained one great access of settlers from Norfolk Island (q.v.), but this only increased his need of labour and provisions without providing any fresh resources worth mentioning. His staff of assistants was young, inexperienced, and too often careless about public affairs and loose in private conduct. Towards the end of his life his troubles were still further complicated by the disturbances in New South Wales consequent on the deposition of Bligh—who on 31 March 1809 landed at Hobart and attempted to use it as a base of operations against Paterson and the irregular government at Sydney. Collins, who depended entirely on Sydney for supplies, refused to allow this, and Bligh angrily denounced him to the British government. Macquarie on his arrival, knowing only Bligh's side of the case, anticipated the lieutenant-governor's recall and his supersession by Foveaux, but maintained friendly relations with him; and on 24 March 1810 Collins died suddenly in his chair. Lieutenant Lord, his young successor, in an endeavour to give public expression to the widespread regret for this loss, ran up an account of over £500 for the funeral expenses; and Macquarie, while feeling bound to disallow the amount himself, strongly recommended the authorities in London to pay it. In 1813 the British government granted the widow a pension of £120 a year.

Apart from Collins's work as a public servant, his chief claim to remembrance is his authorship of the *Account of the English Colony in New South Wales*, which he published in 1798. This work is invaluable as a faithful chronicle of the early years of the settlement, its chief fault —a lack of imagination in the writer—being at the same time its principal virtue. He took his writing seriously, wasted little time over descriptions of scenery or gossip about his fellow-officials and their bickerings, and kept always in view his purpose of narrating actual history exactly and with judgment. The picture he draws is in consequence not a lively or amusing one, as Tench (q.v.) in his account shows it might have been; but it is essentially trustworthy, and beyond doubt the most valuable printed record of the period. Throughout he writes as a witness, giving firsthand evidence. In his second volume, however, which was published in 1802, he is merely a transcriber with some special knowledge. The greater part of his matter is borrowed from Hunter, and long extracts are made from King's journals as regards New Zealand and from Bass's as regards the famous voyage of the *Norfolk*. In 1804 the two volumes were combined and somewhat abridged by his wife; it is this 2nd edition that has usually been reprinted, and many so-called 'histories' issued since then are merely transcripts from its pages. The illustrations, it may be mentioned, were engraved from water-colour drawings made by Edward Dayes (who was never in New South Wales) from sketches made in the colony, apparently by a convict artist, Thomas Watling (q.v.). W.J.

Colonial Office, The. The relations of the Australian colonies with the mother-country have been since their foundation carried on through the British colonial office under that or other names. A list of ministers controlling this office from the first settlement of Australia onwards is therefore given here for convenience of reference. The names by which they were best known are in italics: titles in parentheses were conferred on them after their term of office was at an end: (2), (3), (4) before a name indicate the 2nd, 3rd, 4th time of holding the office.

In 1782 colonial affairs were dealt with by a subordinate branch of the home department, styled the plantations branch; but on 5 March 1784 this business was transferred to a committee for trade and foreign plantations, still under the home department.

Secretaries of State for the Home Department:—

Thomas Townshend, Viscount *Sydney*	22 January 1784
William Wyndham *Grenville*, Baron Grenville	5 June 1789
Henry *Dundas* (Viscount Melville)	8 June 1791
William Henry Cavendish Bentinck, Duke of *Portland*	7 August 1794

In 1794 the home department handed over the management of the war with France, which it had previously exercised, to a new war department, and Dundas was made secretary for war. Owing to a misunderstanding the colonies (which Pitt intended to keep under Dundas) remained with the home department, but the committee for trade was no longer employed to supervise their affairs. The actual amalgamation of the war and colonial departments was not accomplished until 1801; even then the administration of convict affairs remained with the home office.

Secretaries of State for the War and Colonial Departments:—

	Robert *Hobart* (Earl of Buckinghamshire)	March 1801
	John Jeffreys Pratt, Marquess of *Camden*	May 1804
	Robert Stewart, Viscount *Castlereagh* (Marquess of Londonderry)	July 1805
	William *Windham*	February 1806
(2)	Viscount *Castlereagh*	March 1807
	Robert Banks Jenkinson, Baron Hawkesbury, Earl of *Liverpool*	December 1809
	Henry Bathurst, Earl *Bathurst*	June 1812
	Frederick John Robinson, Viscount *Goderich* (Earl Ripon)	30 May 1827
	William *Huskisson*	23 September 1827
	Sir George *Murray*	23 May 1828
(2)	Viscount *Goderich*	22 November 1830
	Edward George *Stanley* (Earl of Derby)	28 March 1833
	Thomas *Spring-Rice* (Lord Monteagle)	June 1834
	George Hamilton Gordon, Earl of *Aberdeen*	20 December 1834
	Charles Grant, Baron *Glenelg*	April 1835

Secretaries of State for the War and Colonial Departments (*continued*):—

	Constantine Henry Phipps, Marquess of *Normanby*	February 1839
	Lord John *Russell*	August 1839
(2)	Lord *Stanley* (Earl of Derby)	August 1841
	William Ewart *Gladstone*	20 December 1845
	Henry George Grey, Earl *Grey*	June 1846
	John Somerset *Pakington* (Baron Hampton)	February 1852
	Henry Pelham Fiennes Pelham Clinton, Duke of *Newcastle*	28 December 1852

In 1854, during the Crimean war, the two departments were separated, and the colonial office properly so called came into existence, in charge of a secretary of state.

Secretaries of State for the Colonies:—

	Sir George *Grey* (of Fallodon)	10 June 1854
	Sidney *Herbert* (Baron Herbert of Lea)	10 February 1855
(2)	Lord John *Russell**	15 May 1855
	Sir William *Molesworth*	21 July 1855
	Henry *Labouchere* (Baron Taunton)	17 November 1855
(3)	Lord *Stanley*	26 February 1858
	Sir Edward Bulwer *Lytton* (Baron Lytton)	31 May 1858
(2)	Duke of *Newcastle*	18 June 1859
	Edward *Cardwell* (Baron Cardwell)	4 April 1864
	Henry Howard Molyneux Herbert, Earl of *Carnarvon*	6 July 1866
	Richard Plantagenet Campbell Temple Nugent Bridges Chandos, Duke of *Buckingham* and Chandos	8 March 1867
	Granville George Leveson-Gower, Earl *Granville*	10 December 1868
	John Wodehouse, Earl of *Kimberley*	6 July 1870
(2)	Earl of *Carnarvon*	21 February 1874
	Sir Michael Edward *Hicks Beach* (Viscount St. Aldwyn)	4 February 1878
(2)	Earl of *Kimberley*	28 April 1880
(4)	Lord *Derby*	16 December 1882
	Sir Frederick Arthur *Stanley* (Earl Derby)	24 June 1885
(2)	Lord *Granville*	6 February 1886
	Edward *Stanhope*	3 August 1886
	Sir Henry Thurstan Holland, Lord *Knutsford*	14 January 1887
	George Frederick Samuel Robinson, Marquess of *Ripon*	17 August 1892
	Joseph *Chamberlain*	28 June 1895
	Alfred *Lyttelton*	9 October 1903
	Sir Victor Alexander Bruce, Earl of *Elgin* and Kincardine	11 December 1905
	Sir Robert Offley Ashburton Crewe-Milnes, Earl of *Crewe* (Marquess of Crewe)	16 April 1908
	Lewis *Harcourt* (Viscount Harcourt)	7 November 1910
	Andrew *Bonar Law*	27 May 1915
	Walter Hume *Long*	11 December 1916
	Alfred *Milner*, Viscount Milner	14 January 1919
	Winston Leonard Spencer *Churchill*	14 February 1921
	Victor Christian William Cavendish, Duke of *Devonshire*	25 October 1922
	James Henry *Thomas*	23 January 1924
	Leopold Charles Maurice Stennett *Amery*	November 1924

*Russell accepted office in February, but was not formally installed in the department till May.

In June 1925 the colonial office was reorganized, the affairs of the Dominions being segregated under a new 'Secretary of State for Dominions Affairs.' To this office L. C. M. S. Amery was for the time appointed; his Dominions staff, however, is housed in the colonial office, the control of which he still retains.

Communication with the colonies has been usually kept up through the permanent under-secretaries, and a list of these is appended. For parliamentary and assistant under-secretaries and other officials the current *Colonial Office List* should be consulted.

Permanent under-secretaries for the Colonies since 1825:—

Robert William Hay (1825), Sir James Stephen (1836), Herman Merivale (1847), Sir Frederick Rogers (1859), Sir Robert George Wyndham Herbert (1871), Sir Robert Henry Meade (1892), Sir Edward Wingfield (1897), Sir Montague Frederick Ommanney (1900), Sir Francis John Stephens Hopwood, afterwards Lord Southborough (1907), Sir John Anderson (1911), Sir George Vandeleur Fiddes (1916), Sir James Edward Masterton-Smith (1921).

Before the reorganization of the colonial office in 1825 official communication with the authorities in Australia was carried on by secretaries of several departments. Phillip and Hunter corresponded with Philip Stephens, secretary of the admiralty from 1763 to 1795, after whom Cook named Port Stephens in New South Wales; Evan Nepean, under-secretary of the admiralty (1782-94), under-secretary for war (1794-5), and secretary of the admiralty (1795-1804); John King, under-secretary of the admiralty in 1792-3, while Nepean was on sick leave, and his successor from 1794 onwards; Charles Long (afterwards Baron Farnborough), secretary to the treasury from 1791 to 1801; and Sir George Yonge, secretary for war from 1783 to 1794. In King's time John Sullivan, an under-secretary for war from 1801 to 1805, took up the correspondence, and a certain M. Lewis seems to have acted as secretary during another of Nepean's illnesses; many official letters were addressed to another member of Lord Hobart's staff, James Chapman. Edward Cooke, who had been an under-secretary for war since 1802, in May 1804 relieved Sullivan of the New South Wales correspondence. King and Bligh also transacted a good deal of business with William Marsden, secretary of the Admiralty from 1804 to 1807, and Bligh with William Wellesley-Pole (afterwards Lord Mornington), who in 1807-9 succeeded Marsden. Macquarie's correspondents were Charles Cecil Cope Jenkinson (afterwards Earl of Liverpool),

under-secretary for war from 1809 to 1810; John Wilson Croker, secretary of the admiralty from 1809 to 1830; Robert (afterwards the great Sir Robert) Peel, an under-secretary for war from 1810 to 1812; Henry Goulburn, who succeeded Peel and was under-secretary until 1821; Henry Edward Bunbury, who was also an under-secretary for war from 1809 to 1816; and John Barrow, second secretary of the admiralty from 1807 to 1845. In Brisbane's time Robert Wilmot (who in 1823 changed his name to Horton) succeeded Goulburn, and in 1825 handed over the affairs of the colonies to Robert William Hay, mentioned above.

Colonies, Creation or Separation of. The mainland of Australia was by Phillip's commission of 1786 divided into two parts at 135° E. long. It was at that time believed that Tasmania was a part of the mainland, but in 1798 Flinders and Bass sailed through Bass Strait and so established its insular character. The original territory of New South Wales, therefore (including New Zealand, which Cook had annexed and Phillip's commission covered), was thus:—

	Square miles
Australia, east of 135° E. long.	1,454,312
Tasmania	26,215
New Zealand	104,471
Total	1,584,998

AUSTRALIA AND NEW ZEALAND, 1786-1836.

On 14 June 1825 Tasmania was constituted a separate colony; this reduced the area of New South Wales to 1,558,783 square miles. In July 1825 the inland boundary of New South Wales was extended westward to the 129th meridian, thus increasing its area by 518,134 square miles to 2,076,917 square miles. Four years later Captain Fremantle annexed 'all that part of New Holland which is not included within the territory of New South Wales,' i.e. the region west of the 129th meridian, comprising 975,920 square miles; this became the colony of Western Australia.

On 15 August 1834, by the Act 4 and 5 William IV cap. 95, the province of South Australia was constituted, and on 28 December 1836 the new colony was officially proclaimed. It embraced 309,850 square miles, lying south of 26° S. lat. and between the 141st and 132nd meridians, which had been part of New South Wales. Thus the area of the mother-colony was reduced to 1,767,067 square miles.

The governors of New South Wales had never taken New Zealand seriously under their jurisdiction, except in so far as they exercised the right of forbidding Englishmen to go there. When it became necessary for some one to exercise a definite authority, the islands were in 1840 first proclaimed a dependency of New South Wales and then, by letters patent of 16 November of that year, constituted a separate colony. Proclamation of the separation was made on 3 May 1841. This separation reduced the political territory of New South Wales to 1,662,596 square miles. In 1846 an attempt was made by W. E. Gladstone, then colonial secretary, to establish a purely penal colony without free settlers (at least at the outset) to be called Northern Australia (see GLADSTONE COLONY). It was to consist of such of the

AUSTRALIA, 1859-1861.

territories of New South Wales as lay north of 26° S. lat. But Earl Grey, the next colonial secretary, almost immediately abolished the colony, and the territories comprised in it reverted to New South Wales.

On 1 July 1851 what had been known as the 'Port Phillip district' of New South Wales was constituted the colony of Victoria, 'bounded on the north and north-east by a straight line drawn from Cape Howe to the nearest source of the River Murray, and thence by the course of that river to the eastern boundary of the colony of South Australia.' The area of the new colony was 87,884 square miles, so that the territory of New South Wales and reduced to 1,574,712 square miles. In pursuance of this process of subdivision, letters patent dated 6 June 1859 granted an independent administration to 'so much of the colony of New South Wales as lies northwards of a line commencing on the sea coast at Point Danger, in latitude about 28° 8′ south, running westward along the Macpherson and Dividing ranges and the Dumaresq River to the Macintyre River, thence downward to the 29th parallel of south latitude and following that parallel westerly to the 141st meridian of east longitude, which is the eastern boundary of South Australia, together with all the adjacent islands, their members, and appurtenances in the Pacific Ocean.' The western boundary was not specifically defined, but by inference was the 141st meridian. The actual separation of Queensland dates from 10 December 1859; its area at this time was 554,300 square miles. New South Wales was thus divided into two parts—one of 310,372 square miles (the present State) and another of 710,040 square miles lying between the meridians of 129° and 141°. No more colonies have been created; but the isolated block just referred to as part of New South Wales has been divided up between South Australia, Queensland, and the Northern Territory. The strip of country south of 26° S. lat. and between the 132nd and

129th meridians, with an approximate area of 70,220 square miles, was on 10 October 1861 (by the authority of the Imperial act 24 and 25 Victoria cap. 44) added to South Australia. By letters patent dated 13 March 1861—which reached Australia and became effective in 1862—a northern strip, described as 'so much of the colony of New South Wales as lies to the northward of the 26th parallel of south latitude, and between the 141st and 138th meridians of east longitude, together with all and every adjacent islands, their members and appurtenances, in the Gulf of Carpentaria' was added to

AUSTRALIA, 1861-1906.

Queensland. The area of South Australia was therefore increased to 380,070 square miles, and that of Queensland to 670,500 square miles. On 6 July 1863 the remainder of the block (thenceforth known as the Northern Territory), containing 523,620 square miles, was by letters patent brought under the jurisdiction of South Australia.

In 1863 was initiated a movement for the separation of the Riverina district of New South Wales—which in those days meant, roughly speaking, the area west of 147° E. long.—from the parent colony. It was a squatters' movement, prompted by the passing of the Robertson land acts (see LAND LEGISLATION), and would have placed nearly half the colony in the possession of about 20,000 people. The proposal was discussed and rejected by the legislative assembly on 16 February 1864; undismayed, the promoters in 1865 forwarded petitions to the colonial office, but were again snubbed, the British authorities thinking it absurd to create a colony without access to the sea, in which the largest town had a population of 800 and only half a dozen more had over 100. Several other attempts have since then been made to split up the existing colonies or States, notably the agitation in Queensland during the nineties for the creation of a new 'North Queensland' centring on Townsville and a new 'Central Queensland' centring on Rockhampton, and the movement at present (1925) existing to create 'new States' in northern New South Wales and in the Riverina—which nowadays means the area bounded by the Murray on the south and elsewhere by a line running through Menindie, Hillston, Narrandera, and Albury. Proposals have also been made in the Commonwealth parliament for the abolition of all present State boundaries and the re-subdivision of Australia into about 20 provinces. But none of these proposals has yet approached success.

From 1863 onwards, therefore, the mainland of Australia was divided into five mutually independent colonies and a 'territory,' while the near-by island of Tasmania and the distant New Zealand were considered informally as part of the same great group of colonies. Between 1885 and 1899 the movement towards federation (q.v.) gathered strength, and eventually brought the mainland colonies and Tasmania into a federal union; New Zealand remained outside, and on 1 January 1901 six colonies and one territory became the 'Commonwealth of Australia,' the designation 'colonies' being at the same time changed to 'States.' The only change in political subdivisions since then was made on 7 December 1907, when the Commonwealth and the State of South Australia entered into an agreement by which the Northern Territory passed under direct Commonwealth jurisdiction. Approval was given by the South Australian legislature under the Northern Territory surrender act 1907 (assented to on 14 May 1908) and by the Federal parliament under the Northern Territory acceptance act 1910 (assented to on 16 November 1910). The Territory was transferred by proclamation to the Commonwealth on 1 January 1911. The total area of the Commonwealth is 2,974,581 square miles. The dates of creation and the areas of its several parts, as determined on the final adjustment of their boundaries, are shown in the following table:—

Colony.	Year of Formation into Separate Colony.	Present Area in Square Miles.
New South Wales ..	1786	310,372
Tasmania	1825	26,215
Western Australia ...	1829	975,920
South Australia	1836	380,070
Victoria	1851	87,884
Queensland	1859	670,500
Northern Territory ..	1863	523,620

Colton, SIR JOHN (1823-1902), born in Devonshire on 20 September 1823, migrated with his father to Adelaide in 1839, and for 20 years pursued a commercial career. In 1859 he entered municipal politics, and in 1862 was elected to the assembly from Noarlunga, but after a term of official life as commissioner of public works in the Strangways ministry (1868-70) left office and parliament in May 1870. Noarlunga again returned him in 1872, and in 1875 he joined James Boucaut (q.v.) as treasurer, leaving him when the ministry was reconstructed in March 1876 and defeating him on a vote of no confidence in June. Colton then formed a ministry of his own in which members of both parties came together, and carried through a big railway construction programme, but in October 1877 he came into collision with the legislative council, which went so far as to depose formally its official leader the chief secretary, Sir Henry Ayers, and elect William Morgan (q.v.) in his place. Displaced by Boucaut in October 1877, Colton again left parliament in 1878, but in 1880 was persuaded to stand once more for Noarlunga, was re-elected, and in 1884 formed a ministry that introduced to office C. C. Kingston and Jenkin Coles, and with the aid of W. B. Rounsevell and R. C. Baker (q.v.), carried an act embodying the principles of land and income taxation. Defeated by John Downer in June 1885, Colton finally left parliament in 1887, paid a long visit to England, and died at Adelaide on 6 February 1902. He was never

a strong partisan, and his frequent resignations were prompted mainly by a business man's dislike of parliamentary delays and squabbles; but he had a keen eye for nascent ability, reinforced his ministries with young men who afterwards became notable, and always retained the personal friendship of his political opponents. He interested himself greatly in Prince Alfred College, and his treasurership of that institution is commemorated by a Colton scholarship and a Colton wing in the buildings. (K.C.M.G., 1892.)

Combretaceae, a widely distributed family, consisting of trees, shrubs, or woody climbers, largely tropical. Of the four genera indigenous to Australia, three are also found in America, Africa, and Asia; the fourth is endemic in Australia. The flowers are in spikes or heads; calyx-tube narrow with 4 or 5 teeth-lobes; petals small or none; stamens inserted on the calyx; fruit usually a drupe with a leathery coat; cotyledons folded or convolute. The most important genus is *Terminalia* (q.v.).

Commerce. See TRADE AND COMMERCE.

Commonwealth Bank, THE. On 22 December 1911 an act to provide for a Commonwealth Bank came into force. The establishment of such a bank had for some years been advocated by the Labour party, and the sixth 'plank' of its fighting platform in 1908 demanded a 'Commonwealth Bank of Issue, Deposit, Exchange and Reserve, with non-political management.' The party's considered scheme proposed that the bank's nominal capital must be held by the Commonwealth and such States as chose to join in, the Commonwealth holding at least 6000 shares and no single State more than 1000. Besides ordinary banking business the bank was to issue notes, float all public loans (Commonwealth, State, or municipal), act as banker for federal, State and municipal treasurers, and buy bullion and issue coin on behalf of the mints. When Labour came into office in 1910, this scheme was in the forefront of its programme; but Andrew Fisher, then prime minister and treasurer, during his visit to London in 1911 to attend the imperial conference of that year, arranged that his permanent advisers (who had accompanied him) should discuss the scheme very fully with the leading English and French banking authorities, and the bank instituted by the act of 1911 owed a great deal to those discussions. The note issue had already been provided for (see CURRENCY); otherwise the new bank was to be an ordinary bank of deposit, controlled by a single governor and carrying all Commonwealth accounts, but having attached to it a savings bank on the usual lines (see SAVINGS BANKS) operating through the federal post-offices. This involved the removal from those offices of the State savings banks, which had been allowed to use them since federation; Tasmania transferred its savings bank to the Commonwealth, but the other States maintained theirs in new buildings, having found the deposits useful as a fund from which State treasurers could borrow.

On 1 June 1912 Denison Miller (q.v.) assumed office as governor of the bank, and at once brought into existence the savings bank department, the Victorian branch being opened on 15 July 1912; by 13 January 1913 savings-bank operations were extended throughout the Commonwealth. On 20 January the bank itself was formally opened for general business at its head office in Sydney, with branches at the five other State capitals, Townsville in Queensland, Canberra (site of the future federal capital), and London. It had no capital resources save the credit of the Commonwealth; a sum of £10,000, borrowed from Commonwealth revenue to meet initial expenses, was repaid as soon as business commenced. A credit balance on general transactions was shown in 1914, and on the savings bank business in 1917. During the war-period (1914-8) the bank extended its activities to meet the special circumstances, and greatly increased both its prestige and its profits by its operations. Branches and agencies of the savings bank department were opened in the soldiers' training camps, on transport ships, and at the front; the service already established on the warships was extended; and the bank made itself responsible for financing Australian soldiers stranded abroad or taken prisoners of war. Moreover, all the general financial business of the Commonwealth was transacted through the bank. It floated government loans to an aggregate sum of £257,719,989; financed the pools for the marketing of primary produce; supplied the means for the purchase of 15 cargo steamers by the federal government; and arranged for secret shipments of gold from Australia on behalf of the Bank of England. After April 1916 it was also responsible for all banking business carried on in the occupied German territory of New Guinea. By June 1922 its profits had accumulated to the amount of £4,001,659, half of which was retained as a reserve fund, the other half becoming a 'redemption' fund against which debentures or stock may be issued if necessary. But by an act of 1923 all future allotments to the redemption fund will go to a sinking fund for the repayment of Commonwealth debt.

In December 1920 the issue of notes became a function of the Commonwealth Bank, being controlled, however, by a separate board of which the governor of the bank was chairman sitting alongside a treasury official and two outside financial experts. In the same month (December 1920) the Queensland government transferred the business of the Queensland Government Savings Bank to the Commonwealth Bank under an agreement ratified by the Queensland parliament.

In August 1924 a new Commonwealth Bank act improved the efficiency of the bank and provided means for making it a central bank. The act established a new board of directors, consisting of the governor of the bank, the secretary of the treasury, and six persons who are or have been actively engaged in agriculture, commerce, finance, or industry. The board controls not only general banking policy but also the issue of Australian notes. The bank's authorized capital is £20,000,000, of which £4,000,000 is paid up by means of a transfer from the reserve and redemption funds. With a view to helping the bank to become a central bank it is provided that, after a date to be proclaimed by the Commonwealth government, other banks are to settle balances between them by cheques drawn on the Commonwealth Bank.

Compositae, the most numerous and wide-ranging family of flowering plants, with a great variety of form and colour; 635 species are recorded from Australia. They are generally divided into two groups (1) Tubuliflorae, in which the disk florets, at least, are tubular, e.g. daisy and sunflower, and (2) Liguliflorae, in which all the florets are strap-shaped, e.g. dandelion. *Pterigeron* is an endemic genus; *P. liatroides*, an inland species, yields a delicious perfume. *Epaltes*, a small genus of herbs, has

two indigenous species; *E. australis*, a prostrate plant with dull brown, rayless flowers, usually frequents sour, ill-drained land. *Nablonium* is a genus of one species, *N. calyceroides*, a creeping herb usually growing in marshy places. It occurs on King Island and other islands in Bass Strait, and on the Tasmanian coast. *Erigeron*, a widespread genus (the fleabanes), contains the alpine herb *E. pappochromus* and the introduced weed *E. linifolius* (Cobblers' Pegs). *Raoulia eatipes* (Australian Edelweiss), is a dwarf alpine herb, which grows in low silvery tufts over considerable areas on Mount Kosciusko above the 5000-ft. line. *Ammobium alatum*, one of the 'Everlastings,' with chalk-white flowers, is a common garden plant. Its stems are bordered by a broad membranous wing. *Gnaphalodes uliginosum* forms dense mats on the western plains of New South Wales. The clusters of flower-heads are embedded in the woolly floral leaves. *Wedelia biflora*, a widely distributed coastal species, is usually found scrambling about the cliffs on rocky coasts. *Craspedia Richea*, chiefly found in grass-lands, has a number of small flower-heads collected in a semi-globular mass at the top of a common flower-stem. See BEDFORDIA, BIDENS, BRACHYCOME, CALOTIS, CASSINIA, CELMISIA, CENTIPEDA, COTULA, GNAPHALIUM, HELICHRYSUM, HELIPTERUM, OLEARIA, SENECIO.

Condamine, THOMAS DE LA (1797-1873), educated at the Royal Military College at Sandhurst (which he entered in 1814), was in 1825 commissioned lieutenant in the 57th regiment and in the next year joined Darling's staff as aide-de-camp and military secretary. Darling had a high opinion of his services, and in April 1827 made him collector of internal revenue—an appointment which was not confirmed in London, Bathurst having almost simultaneously directed another appointment. Condamine's hobby was education: he undertook gratuitously the management of the 'Carters Barracks,' a sort of elementary technical school, and was on the managing committee of the Female Factory, while as a private citizen he helped to found on 3 February 1826 a circulating library out of which grew in course of time the present public library of New South Wales. When Darling gave him the civilian appointment mentioned above, he applied for permission to resign from the army; when the appointment fell through, he withdrew the application and stayed in New South Wales as aide-de-camp, going back to England with Darling; he was then promoted captain, but assigned to no regiment, and placed on half-pay. He died in 1873.

Conder, CHARLES (1868-1909), born in London in 1868, and taken by his father to India while still an infant, was sent back in 1877 to England to be educated at Eastbourne, and at the age of 16 migrated to Sydney to enter the department of lands as an assistant surveyor. But his bent was wholly towards art; he studied in Sydney at the Royal Art Society's classes and in Melbourne at the National Gallery schools, besides learning much from association with fellow artists—B. E. Minns in Sydney and Tom Roberts and Arthur Streeton in Melbourne (see ART). For a time he was on the staff of the *Illustrated Sydney News*. In 1888 the Sydney gallery bought his 'Departure of the s.s. *Orient*,' exhibited in that year's show of the Art Society of New South Wales. In 1889 with Roberts and Streeton he exhibited a number of 'Sketches and Impressions' in Melbourne, and in 1890 he showed several pictures at the Victorian Artists' show. The generosity of an uncle then enabled him to return to London and settle to study in Paris, where in 1893 he was elected an associate of the Société Nationale des Beaux Arts. A few lithographs of his are known, a single dry-point, and a number of landscapes in oils, usually of seashores peopled by fashionable crowds; but the work he did best, by which he will be longest known, are delicate panels done in water-colour on silk, often shaped as fans. He was a member of the Société Nouvelle des Beaux Arts and of the International Society of Painters, and was honoured by having his work placed in the Luxembourg galleries. In 1907 he was incapacitated by severe illness, and died at Virginia Water near Windsor in England on 9 February 1909.

W.M.

Congregationalists. The history of Congregationalism in Australia is closely intertwined with that of two great missionary societies, the London Missionary Society and the Colonial Missionary Society, the first of which was founded in London in September 1795, its original name being simply 'The Missionary Society.' Its sole object was 'to spread the knowledge of Christ among heathen and other unenlightened nations.' The Colonial Missionary Society was also founded in London, largely under the influence of Thomas Binney and T. Q. Stow (q.v.) in 1836. Its object was to establish Congregational Churches in the British colonies. Between 1795 and 1836 the connection between the London Missionary Society and Congregationalism in Australia was particularly close, as is shown by a letter written from Parramatta, in New South Wales, on 29 August 1799 by William Henry, in which he states that 'in the beginning of August 1798, Mr. Cover and the writer began to preach in this colony in different places in the country, about the town of Parramatta.' 'Mr. Cover' was James Fleet Cover, one of a band of about 30 missionaries, who had been sent in the ship *Duff* to Tahiti, and some of whom afterwards settled in New South Wales. There is no evidence, however, that James Cover attempted to organize a Congregational Church, and very possibly such an attempt would have been frowned upon by the authorities of the day.

In 1801 Samuel Marsden (q.v.), the colonial chaplain, became the official correspondent and adviser of the London Missionary Society, especially with regard to the Tahiti mission. The London Missionary Society, though largely supported by Congregational funds, was not then (nor has it ever been since), strictly a Congregational society. Marsden afterwards came into collision with one of the missionaries, William Pascoe Crook (q.v.), concerning the celebration of the Lord's Supper. Crook it was who in August 1810 organized the first Congregational Church at his schoolhouse at the corner of Bligh and Hunter-streets, Sydney. This first Church consisted of five persons—Crook himself, three missionaries (Davies, Wilson and Tessier), and John Hosking. They had a church book with regular minutes, from which Crook quotes. Whether this movement survived we do not know. Probably it lapsed with the removal of its founder to Moorea in the South Seas in 1815, if not before. At any rate Daniel Tyerman and George Bennet, who visited Sydney in the interests of the London Missionary Society in 1824-25, reported that they could find 'no In-

dependent cause whatever' in that city. Crook returned to Sydney in 1830, and resumed his ministerial labours in the colony on 19 December in a chapel in Macquarie-street.

In 1828 there resided at Hobart in *Tasmania* a certain Henry Hopkins, an energetic, prosperous, generous man with a strong sense of responsibility combined with plenty of initiative. He had arrived in Hobart with his wife in 1822; they were Independents, and did not find in Hobart exactly what they needed in the way of religious life; they therefore asked the directors of the London Missionary Society to send out a minister. To do this was not within the Society's functions, so the letter was passed on to the authorities of Highbury College. Work in a distant outpost of the Empire appealed to a young man, Frederick Miller, who volunteered and, after being ordained, sailed for Hobart, arriving in September 1830. At first he preached at 'Dean's Rooms,' conducting his initial service on 17 October; these services he continued for 18 months, and a Church of nine members was formed in March 1832. In April the Brisbane-street chapel was opened for worship, and there Frederick Miller ministered until his death in 1862. The foundation-stone of a handsome memorial church was laid by Henry Hopkins on 16 August 1870. In 1832 Miller was joined by a fellow student of his at Highbury College, Charles Price (q.v.), who, after spending a few months in Launceston, proceeded to Sydney with the expectation of becoming the minister of the Pitt-street congregation. This expectation being disappointed he went to Carrington on Port Stephens, and acted as chaplain to the Australian Agricultural Company (q.v.) until March 1836; then he returned to Launceston and became pastor of the Tamar-street church, remaining a conspicuous and influential figure in the life of Tasmania until his death in 1891. In Hobart a second Church was established in Collins-street under the care of James Nesbit in 1836. In 1856 a fine church was built in Davey-street, and there for more than 50 years George Clarke (q.v.) exercised a distinguished ministry; he was a man of exceptional culture, and was closely identified with the Tasmanian university, being its second chancellor.

As already noted, the Colonial Missionary Society was formed in 1836, and with its assistance Joseph Beazley was sent as a home missionary to Tasmania, leaving the island after some years to settle in New South Wales. Under the auspices of the same society John West (q.v.) and Alexander Morison came to Tasmania in 1838. West, who settled in Launceston as pastor of a church in St. John's Square—(Christ Church, of which William Law was subsequently for many years minister), won a permanent place in Australian literature as the historian of Tasmania, and, coming to New South Wales, became editor of the *Sydney Morning Herald*. Morison took charge of the Pittwater district, where he preached at no less than 42 stations, and was instrumental in the erection of churches at Cambridge, Carlton and Richmond; he, too, ultimately felt the call of the mainland and settled in Melbourne in 1843 as minister of the Collins-street church. At the present time, in addition to the churches in Hobart and Launceston, Congregationalism is represented at Newtown, Bellerive and Lindisfarne (suburbs of Hobart), Geeveston, Franklin and Huonville in the south; at Latrobe, Don and Devonport in the north; and at Richmond, Kempton, Dover, Bream Creek and Taranna inland. The first council of the Tasmanian Union met in Hobart on 20 August 1867.

Congregationalism in *New South Wales* was first firmly established in 1828, when James Hayward and Robert Bourne, two of the Tahitian missionaries, with Ambrose Foss, a chemist, and Edward Hunt, inaugurated a movement in Sydney; the first service under these auspices was conducted by Charles Smith (a doctor of medicine as well as an ordained minister) at Hayward's house in Castlereagh-street on 22 November 1829. A site for a church was obtained in Druitt-street, but not used; a site on the western side of Pitt-street, on which the School of Arts now stands, was then procured, and the foundation-stone of the church laid by Hayward on 26 March 1830. (Later authorities give the date as 12 April—Easter Monday—but the contemporary evidence of the *Sydney Gazette* for 1 April would seem decisive.) This church was opened for worship on 15 February 1833, Charles Price and three Methodist ministers taking the chief part in the ceremonies. Price came over from Launceston at the desire of the congregation, their request for a minister from Highbury College having been unanswered for a long time; but on 21 March W. Jarrett arrived unexpectedly, and Price moved on to Port Stephens. Jarrett thus became the first permanent minister of the Pitt-street church, retaining the position until 27 April 1838. On 2 May 1833 a Church fellowship of 12 persons was formed under his leadership, consisting of W. Jarrett, J. Hayward, W. P. Crook, Hannah Crook, Richard Bourne, Ann Bourne, Sarah Stafford, Henrietta Stafford, Ambrose Foss, T. Hutchinson, Thomas Dunton and George Wagg. After Jarrett's departure the building was let for a while to John Dougall, an Irish Presbyterian minister.

A new era dawned with the arrival on 25 February 1840 of Dr. Ross, who had been sent out by the Colonial Missionary Society. His career had been chequered. He was educated for the ministry in Edinburgh, and, intending to go as a missionary to the Russian empire, qualified as a doctor of medicine; but soon after his arrival in Russia all foreign missionaries and Bible agents were driven from the country. In 1824 he returned to England and settled at Kidderminster, remaining there until 1836. His ministry of nearly 12 years in Sydney was successful and widely influential. He gathered round him men of exceptional quality, such as George Allen, Ambrose Foss, David Jones, Joseph Thompson, Robert Garrett and John Fairfax; and under his capable leadership the denomination began steadily to expand. In 1841 a church erected at South Head, towards which W. P. Crook had raised many subscriptions—a stone building with a chimney, standing near the Macquarie lighthouse on the site of the present fire station—was opened by Dr. Ross. Edward Lancelot Threlkeld, who had been a missionary in Tahiti and to the aborigines at Lake Macquarie, became its pastor, remaining in charge until in 1845 he moved to the Mariners' Church, Sydney; here he ministered until his death in 1859. In 1841, also, was laid the foundation-stone of a new church in Pitt-street, on the site of the church now existing; the ceremony was performed by Dr. Ross on 29 January. Owing to commercial depression there was much delay in the building, but it was ultimately opened for worship on 1 January 1846. At Redfern in September 1847 a fellowship was formed, and a building opened in October. J.

Beazley, from Tasmania, was the first in a succession of able ministers including W. Slatyer, George Campbell and Frederick Binns.

In 1853 William Slatyer made an effort to start work in Bathurst; disappointed there, he returned to Sydney and initiated services in a room in the Happy Vale hotel at Surry Hills. Hence arose the Bourke-street Church; a fellowship was formed in 1855, and the church building opened the same year. The year 1854 was a busy one. A Church was formed at West Maitland, under the ministry of John Waraker, who had arrived in New South Wales in 1851; the church building was opened in 1858. In 1854, too, George Charter settled at Petersham, moving later on to Wollongong; and the local Churches were visited by J. F. Poore, a man of great energy and enthusiasm. Work at Newtown, a suburb of Sydney, was commenced in 1855 by S. C. Kent, and Churches were formed at Petersham in 1863 and at Parramatta in 1870. At present Congregationalism has about 100 preaching stations in New South Wales.

The central church in Pitt-street was after Dr. Ross's death served by W. Cuthbertson, John Graham, James Jefferis (q.v.) and others; Nicholas J. Cocks took charge in 1907, but died in January 1925, and was succeeded by Thomas E. Ruth. In 1864 Camden College was established both as a boys' school and as a theological college. Its home was a property at Newtown which had belonged to Thomas Holt, M.L.A., and had borne the name 'Camden Villa.' Holt sold it to the denomination for £4000 (about half its value). Josiah Mullens was the first secretary of the college, John Fairfax the first treasurer, and S. C. Kent the first principal. In 1872 J. G. Fraser, M.A., was appointed warden, and held the office until 1909. He was a man of great ability, strong personality, and vast and accurate learning. With these gifts were combined patience, tact, wisdom and capacity for teaching. Through his students (some of them men of real distinction) he exerted a far-reaching influence on the religious life of Australia. He was succeeded in 1910 by the present warden, G. W. Thatcher, M.A., B.D.

In 1866 a Congregational Union was formed, which was incorporated in 1882. In 1903 a home mission board was formed, under W. L. Patison.

Behind *Victorian* Congregationalism, as behind Tasmanian, stands the beneficent figure of Henry Hopkins of Hobart. He visited the infant settlement at Port Phillip in 1837, and, struck by its possibilities, asked the Colonial Missionary Society to send a minister thither, at the same time forwarding a sum of money to cover his expenses. In response to his appeal William Waterfield reached Melbourne on 22 May 1838. At first services were held at John Pascoe Fawkner's public-house. A fellowship was formed in 1839. By a strange lapse from the Congregational principle of 'No state aid to religion' an application was made to the Sydney authorities for a grant of land; two acres were given, at the corner of Collins- and Russell-streets, and here the foundation-stone of a church was laid by Henry Hopkins on 6 September. The opening ceremony took place on 15 January 1841. Twenty-five years later this building was replaced by the existing structure. The Collins-street church was the first permanent building for public worship in Melbourne. For 11 years after Waterfield's arrival it was the only one the denomination possessed. He left for Tasmania in 1843, and was succeeded by Alexander Morison, whose work in Tasmania has already been noticed. The year was marked by the formation of the Port Phillip Colonial Missionary and Christian Instruction Society, whose aims were noble, though it failed to obtain workers and soon died out. In 1849, however, the population of the settlement having greatly increased, ministers began to arrive, among them B. Cuzens in 1849 and Thomas Odell in 1850; and between 1849 and 1854 11 new 'causes' were commenced —three in Geelong, the rest in Lonsdale-street (Melbourne), Prahran, Kyneton, Collingwood, Richmond, Brighton, St. Kilda, and White Hills near Bendigo. Since that time the denomination has developed until now it possesses about 90 churches and preaching places in town and country.

In 1854 a great impulse was given to the work in Victoria by the arrival of Richard Fletcher, J. F. Poore and Edwin Day, all three exceedingly able men, who were induced by the Colonial Missionary Society to migrate to Victoria, the Society becoming responsible for travelling expenses and stipends. They were designated 'Professor Fletcher, Evangelist Poore, and Pastor Day,' appropriate titles, happily suggesting the parts they were expected to play. A Congregational Union constituted in Melbourne on 8 June 1852 having lapsed, the existing one was formed on 1 March 1860. In February 1855 there met in Melbourne under the chairmanship of T. Q. Stow (q.v.) an intercolonial conference of two ministers from New South Wales, two from Tasmania, two from South Australia and eight from Victoria, the lay delegates including J. Fairfax, Ambrose Foss and Henry Hopkins. Other conferences were held at Sydney in February 1857, and at Adelaide in November 1859.

In 1861 the Congregational College of Victoria was established for the training of ministers. For many years Alexander Gosman, D.D., was its principal; he was a vigorous, independent and fearless thinker and speaker, and in addition to his academic work exerted a wide public influence. Sympathetic with the aspirations of the masses for better conditions, he was entrusted with the chairmanship of the shirt-makers' wages board—a unique honour for a clergyman.

The planting of Congregationalism in *South Australia* was almost coincident with the planting of the colony, and the two grew up together. In October 1837 T. Q. Stow (q.v.) reached Adelaide in the *Hartley*, and with characteristic energy began work at once. A service, at which Governor Hindmarsh was present, was held in a tent, and a Church fellowship of 11 persons was immediately formed, including T. Q. Stow, Robert Tod, John J. Barclay, William Finlayson, Edward Webb, James Wright and James Harrington. The first church building was made of pine logs thatched with reeds; a substantial building in Freeman-street was opened on 1 November 1840; the Stow Memorial church in Flinders-street (in which, of course, Stow himself never ministered) was dedicated to Divine worship on 12 April 1867. Stow's successor was C. W. Evan, a man of great culture, who came to Adelaide in 1855 in search of health. He resigned in 1871 and died in 1876. In March 1876 W. R. Fletcher, a man of great natural ability, sedulously cultivated, began a ministry of 14 years' duration, and his successor Joseph Robertson also served a 14 years' term in 1890-1904.

The second Church to be formed in the city, at Hindmarsh Square, dates from 1851. F. W. Cox, a man of singular sagacity, arrived in 1857 and was for 40 years its pastor. In the Brougham Place Church at North Adelaide James Jefferis

(q.v.) swayed the life of the city. It was formed on 20 October 1859, with about 20 members. Under Jefferis's robust leadership this number rapidly increased, and its vigour has been shown by the production of daughter Churches at College Park, Medindie and Crafer's Park. Services were started at Hindmarsh (not to be confused with Hindmarsh Square) in 1838, and a fellowship was formed in 1849. Clayton Church at Kensington dates from 1854, Glenelg from 1863 (services having been commenced there in 1847), and Port Adelaide from 1849; here for many years J. C. Kirby fulfilled a vigorous and effective ministry. The Congregational Union was formed in 1850, and incorporated in September 1877: it now includes about 80 churches and preaching stations.

South Australian Congregationalism has been singularly fortunate not only in its ministers, but it its laymen, such as William Peacock, who claimed to have a brick in every church in the colony; John Howard Angas, son of George Fife Angas (q.v.); and W. Parkin, the munificent founder of the Parkin college and the Parkin mission. The Parkin college is a well-endowed institution for the training of Congregational ministers; its first principal was L. D. Bevan (q.v.), who was followed by E. S. Kirk. The Parkin mission exists to give on Christmas Day every year five pounds each to 20 poor widows, and to pay the stipend of 'missionaries of the Congregational denominations.' In 1858 the great London preacher, Thomas Binney, paid a highly stimulating visit to South Australia.

Congregationalism in *Queensland* antedates by ten years the separation of the colony from New South Wales. In 1849 a little company of devout men and women at Ipswich used to meet for worship, and such a group is in essentials a Congregational Church. Of this Ipswich group a schoolmaster named Welsh acted as lay-pastor until nearly 1853. Meanwhile a Baptist minister, Thomas Deacon, arrived in 1850, a congregation gathered round him (at first in the court-house, then in a cottage adapted for the purpose of worship), and it was decided to form a 'United Congregational Church,' which would include both Baptists and Independents. A fellowship was formed, consisting of 12 persons. In 1854 Deacon resigned, the name was changed to 'Congregational Church,' and negotiations were opened with the Colonial Missionary Society, with the result that before the year's end Edward Griffith was sent out as pastor. A church was opened, free of debt, on 11 March 1855. In 1856 an exchange was arranged by the Congregational Missionary Society of New South Wales between Griffith and J. T. Waraker of West Maitland, who remained in Ipswich for about three years and a half; his aggressive policy of starting branch Churches so characterized the Ipswich Church in later years that Ipswich has become a sort of Congregational diocese, a mother Church sitting in the midst of her numerous daughters. In Brisbane in the early days Independents, Baptists and Presbyterians formed a 'United Evangelical Church,' managed (as such a Church must necessarily be) on Congregational principles. The Colonial Missionary Society, aware of the approaching separation of Queensland from New South Wales, sent out George Wight to promote Congregational work. He preached at first in a 'rickety loft, reached by a rickety trap ladder,' and received a visit of encouragement from Thomas Binney. A church at the corner of Wharf- and Adelaide-streets was completed by 10 June 1860, in which year E. Griffith (father of the late chief justice of Australia) became the pastor; he retained the office for 30 years. Wharf-street was also a prolific mother of Churches—Goodna (1863), South Brisbane (1865), Oxley (1871), Redcliffe (1880), O'Connell Town and Bowen Hills (1887) and Milton (1891). In Toowoomba J. T. Waraker laboured for 24 years. In Rockhampton the work was begun in 1861 by Samuel Savage. The Colonial Missionary Society at one time was accustomed to grant £300 a year to the work in Queensland.

The Congregational Union dates from 15 October 1861. It now includes about 50 churches and preaching stations. There is a college for the training of ministers; a college house was opened at Annerley on 24 March 1923, the gift of Frederick Marsden, with F. North as principal.

Although *Western Australia* was founded in 1829, Thomas Johnston reported in 1883 that there were only three Congregational Churches in the colony. Since that time a vigorous forward policy has been pursued, for which Trinity Church, Perth, and W. T. Kench, its capable minister for many years, are largely responsible, so that now the Congregational Union in the State includes about 70 churches and preaching stations. Here, as elsewhere, the Colonial Missionary Society has been helpful, having contributed up to 1903 about £5200 towards home mission work. In 1845 Henry Trigg first held services in his own house in Perth. In 1846 a small chapel was erected, where for years he preached gratuitously. When application was at last made to the Colonial Missionary Society for a minister, J. F. Leonard came out in 1851, but after three years moved to Gawler in South Australia. In 1862 the Colonial Missionary Society sent out another minister, J. M. Innes, who laboured in Perth for six years (a new church being erected during his pastorate), and then joined the Presbyterians. Then followed D. Meadowcroft, during whose time a manse was built. Bunbury Church, like Trinity Church, Perth, owes its initiation to a consecrated layman, John Allnutt, who in 1848 gathered a few people together for the reading and exposition of the Scriptures at Australind, about seven miles from Bunbury. Out of this grew a similar movement in Bunbury, where a small building was erected in 1855. Here, as well as at Australind, Allnutt continued to labour until his death in 1864. At Fremantle in 1851 a small religious society was formed and occasionally visited by Henry Trigg. In 1853, in response to an appeal to the Colonial Missionary Society, J. Johnston came to Fremantle; a small chapel was erected in 1854; then came a manse, and in 1877 a church with accommodation for 500 persons. Johnston had been for 11 years a missionary in Tahiti, so that our story both opens and closes with the London Missionary Society and its work in the South Seas. Fittingly, therefore, Australian Congregationalism has taken a great interest in the work of this Society and has contributed largely to it in both money and consecrated personalities.

The Australasian Union. In Congregationalism there is a strong strain of individualism, but also a strong instinct for fellowship. Hence arose both local groups, the individual Churches, and the combination of these into unions, which are found in every State of the Commonwealth. Quite early there manifested itself a craving for a wider union still, from which sprang the intercolonial conferences at Melbourne in 1855, at Sydney in 1857 and at Adelaide in 1859. Jubilee celebrations were held in Hobart in 1880, in Syd-

ney in 1883, in Adelaide in 1887, in Melbourne in 1888, and in Brisbane in 1903. It was at the Brisbane meetings that the Congregational Union of Australia and New Zealand, constituted at Melbourne in 1888, was revived. A. J. Griffith, M.A., was the energetic secretary for more than 16 years. To his devotion and tenacity of purpose the present strength of the movement is largely due.

Church Union. Congregationalism in Australia is sympathetic towards the idea of organic union between the Methodist, Presbyterian, and Congregational denominations. This was emphatically shown by a vote taken at the eighth triennial assembly of the Australasian Union, held at Sydney in 1922, when 78 voted in favour of union and nine against. Indeed, the opposition of the nine was not to the general idea of union, but to its consummation on a basis of doctrine and polity about which they entertained doubts and scruples.

Statistics. In 1922 the members of Congregational Churches in Australia numbered 21,654; the Sunday-school scholars 31,993; and the churches and preaching stations 497. These figures, which were given at the Australasian Union meetings in 1922, possibly include New Zealand.

F.V.P.

Conolly, PHILIP (1786-1839), born in Kildare county, Ireland, in 1786, trained for the priesthood, and engaged for some years in parochial work in the diocese of Kildare and Leighlin, volunteered in 1819 for the Catholic mission to Australia, and with John Joseph Therry (q.v.) sailed for Port Jackson in the *Janus* from Cork on 5 December. His appointment was official as well as ecclesiastical; he ranked as a government chaplain with pay of £100 a year. Reaching Sydney on 3 May 1820, the two priests set to work to organize the mission, which at the time was concerned to a large extent with convicts belonging to their Church who had for many years been left without religious ministrations. Although Father Conolly was the senior priest and nominal head of the mission, Father Therry was so much the more forcible character that the work in Sydney became entirely his, and will be narrated under his name; Father Conolly, finding their temperaments incompatible, in March 1821 migrated to Hobart. Accounts of his career in Tasmania have hitherto been based mainly on a report made by Father Ullathorne in 1833, when Father Conolly had been working for 12 years among small and scattered congregations and was a sick and worn-out man. Recently published official records (*H.R.A.* III. iv, v.) show, however, that the earlier years at least of his term were more successful than Ullathorne knew. He appears as a friendly mediator between Sorell and aggrieved settlers, and in 1824-6 was commended by Sorell, Arthur, Bathurst, and Dr. Poynter for satisfactory work. Arthur was especially loud in his praise, and on 1 February 1826 strongly recommended the doubling of his pay —which Bathurst coldly refused as inconsistent with the rate paid to other priests. In 1824-5 a curious episode disturbed his peace; Father Samuel Coote, who had in 1823 volunteered to join him in Tasmania as an assistant, claimed on arrival at Hobart to supersede him as official chaplain, and Arthur had some difficulty in getting rid of the intruder. Coote in the correspondence betrays himself as evasive and intriguing, and it may have been the local quarrels arising out of this episode (for Coote evidently gained the support of some Catholics there) that took the heart out of Conolly's ministrations, and brought about the negligence described by Ullathorne in 1833. Coote, whose conduct was severely condemned by Dr. Poynter, had left Tasmania for England in 1826, but ill-feeling often lasts far beyond the removal of its immediate cause.

From 1826, when he was still in favour with both official and ecclesiastical authorities, to 1833, when Ullathorne found religion in Tasmania 'in a state of complete decline,' there is no published record of Father Conolly's doings; but when Bishop Polding arrived in 1835, he was past work and impracticable. He claimed as his private property the land on which the chapel was built—a claim legally correct, since Sorell had made the grant to Conolly personally on the ground that he had brought capital (actually £14) into the colony, but ecclesiastically wrong, since the land had been dedicated by Conolly himself to Church uses. He even issued a writ against Dr. Polding, and had him arrested; this extravagance alienated the last of his friends, and he was superseded without trouble, at first by Father Watkins, then (in April 1838) by Father Therry. The recalcitrant priest was, however, ageing fast, and mellowing as he aged; he was reconciled to Father Therry and to the bishop, and died on 3 August 1839 in full communion with his Church.

E.M.O'B.

Conospermum, a genus of the family Proteaceae, consisting of shrubs endemic in Australia, and most of them in Western Australia. The flowers are blue, lilac, pink, or white in short dense spikes; corolla-tube either straight with 4 equal spreading lobes, or 2-lipped, the upper lip broad and concave, the lower one with 3 narrow lobes; stamens inserted in the swollen base of the tube or the concave base of the lobes; fruit a small obconical nut, with a broad, flat or concave apex covered with long silky hairs; leaves entire. Several species are known as 'smoke-bushes,' their densely crowded spikes of woolly grey and white flowers looking, at a distance, like smoke. Grazing animals browse with avidity on the downy flower-spikes, rejecting the foliage, so that the plants are not destroyed by excessive cropping. *C. tenuifolium,* a prostrate plant with wiry, grass-like leaves and pretty bluish flowers, is endemic in New South Wales.

Constitutions, State and Federal.

The constitutional development of Australia provides instances of the main types of government in British communities, from the earliest and most dependent stage of the crown colony to that of the adult and autonomous State or dominion.

From 1788 to 1823 the settlement in New South Wales was a crown colony of the extreme type, the governor having practically absolute power; the administrative officers also were military or naval men, not civilians. Until 1825 the governor's commission gave him control over all Australia east of 135°E. long., including Tasmania and the adjacent Pacific islands between 10° 37′ and 43° 39′ S. lat. New Zealand was not specifically mentioned, but early governors issued proclamations affecting that country, and thus demonstrated that they considered it within the ambit of their jurisdiction. In New South Wales the governor at the outset exercised legislative, administrative, and judicial functions. There was no other legislative body, hence his proclamations had temporarily the force of law—they needed, however, confirmation by the colonial office to make them permanently valid. He was

assisted in the administration by a few officials, including a lieutenant-governor and a judge-advocate, but they were subject to him and could be dismissed by him. The financial administration, such as it was, was in his hands. And, though courts of justice were established, he had the nomination of judges and magistrates, was himself the court of appeal, and could order summary punishment of offenders, or pardon them at his will. 'He was,' says Rusden, 'not only vicegerent, charged with the awful power over life and death; on him fell also the care of the infant settlement in its most trivial affairs. For him it would be to negotiate bills in England, to influence shipments of foods and necessaries, to distribute land, to foster agriculture, to settle disputes. He was himself the local Court of Appeal. From no petty trifle could he escape, from no high duty could he shrink.' The settlement was of a military character; the court of criminal jurisdiction was a court martial, in that it consisted of the judge-advocate and six naval or military officers. The civil court consisted of the judge-advocate and two inhabitants, in practice a military officer and either a civilian or a naval officer.

In 1814 the civil and criminal courts were placed under separate authorities, and the civil court was developed into a supreme court and a governor's court. The supreme court, consisting of a judge appointed by the colonial office and two magistrates appointed by the governor, heard cases in which sums greater than £50 were involved. Appeals were still heard by the governor and judge-advocate for amounts between £300 and £3000; where amounts beyond the higher limit were involved, an appeal lay to the privy council in England. The governor's court, a continuation of the original civil court, consisted of the judge-advocate and two inhabitants, but its jurisdiction was restricted to cases involving not more than £50. The system was still defective, both for lack of a civilian jury system, and because the judge-advocate as judge had to give decisions in cases in which as advocate he had initiated the prosecution.

New South Wales.—The first four governors of New South Wales were naval officers. The constant quarrels of all except Phillip with the local military authorities, and their inability to suppress the illicit rum trade then rampant in the colony, forced in 1809 the appointment of a military officer, Colonel Lachlan Macquarie. His autocratic administration, together with his patronage of emancipists (q.v.) resulted in the appointment of J. T. Bigge (q.v.) as commissioner to investigate and report on the colonial administration; and Bigge's report (made in 1822), following on the opportune publication of W. C. Wentworth's book on New South Wales in 1819, led to constitutional concessions in 1823, when the New South Wales judicature act was passed. This act constituted the first breach in the system of gubernatorial autocracy. A legislative council was created, to consist of five, six or seven members appointed by the governor. In December 1825 the councillors were the lieutenant-governor, the chief justice, the archdeacon, the colonial secretary and three civilians—John Macarthur, Robert Campbell and Charles Throsby. The four official members of the legislative council also constituted the executive council, which formally came into existence on 20 December 1825. The governor presided over the legislative council, and initiated legislation. He still had power to issue ordinances contrary to the will of the majority of council, so long as one councillor supported him; in the event of rebellion (or even threatened rebellion) his will prevailed against a unanimous council, though no ordinance could be issued before submission to the council. All legislative proposals, before they were considered by the council, were submitted to the chief justice, who determined whether they were compatible with English law. The British parliament could revise all colonial laws and ordinances, and, finally, the crown could exercise its right of veto. Consequently the concessions made in 1823 were much restricted, the council having little power beyond the right of taxation and of free criticism; and against the latter the official or nominee character of its personnel was a safeguard. No tax or duty could be levied except for local purposes—that is, the colonies could not be exploited for the benefit of the Imperial revenue.

The same act provided further judicial reforms. Francis Forbes was appointed the first chief justice, and the offices of judge and advocate were separated. The supreme court was to consist of two or three judges. Limited provision was made for a civilian jury in civil cases to the extent that if the parties to a suit so desired, it might be heard before a jury of 12 men each possessing at least 50 acres of freehold or dwelling worth £300 or upwards. Criminal cases were still court-martialled before a judge and seven military or naval officers; though Chief Justice Forbes, whose sympathies were with the emancipists, held that by reason of a verbal defect in the act jurors could be empanelled at quarter sessions. The right of challenging jurymen was recognized. In addition to quarter sessions, which could be held at such times as the governor appointed, local courts of requests might also be instituted to hear cases for claims up to £10. An important provision of the act permitted the separation of Tasmania from New South Wales whenever the colonial office thought fit.

The original intention of the British parliament was that the act of 1823 should remain in force till 1 July 1827; but by a special act it was continued in operation until 25 July 1828, when the provisions of the act of 1823 were slightly amended. The legislative council was numerically strengthened; it was to consist of from 10 to 15 members, thus providing for a greater proportion of non-official members. The governor was directed to preside at its meetings, and was given a casting vote. The veto of the chief justice on proposed legislation was abolished, but the supreme court was to advise the governor, within 14 days of the passing of an act, if it were in any way repugnant to British law. Furthermore the governor was no longer allowed to issue ordinances against the wish of his council. Regarding judicial matters the intermediate court of appeal, consisting of the governor and the chief justice, was abolished, and all appeals from the supreme court went direct to the privy council in England. Trial by jury, which under the act of 1823 could not be granted unless both parties to a case asked for it, was in 1828 made grantable by the supreme court on the application of either party. In 1832 trial by jury was made available in cases involving certain crimes and misdemeanours, and emancipists with freehold worth £300 or an income of £30 became qualified to serve as jurors. In 1839 military juries were dispensed with, and all crimes and offences were tried before a jury of 12 citizens.

With the increase in the number of free settlers, the raising of public revenue within the colony, and the cessation of transportation in 1840, the question of giving New South Wales a larger endowment of political freedom became urgent. Largely through the agitation kept alive by Wentworth and his friends in the Australian Patriotic Association, an 'Act for the Government of New South Wales and Van Diemen's Land' was passed in 1842. The legislative council of New South Wales was henceforth to consist of 36 members, 12 nominated by the governor, the rest to be elected by owners of freehold worth £200 and householders paying £20 (lowered to £10 in 1850). The district of Port Phillip (which had in 1841 unsuccessfully petitioned for separation) returned five members, the town of Melbourne, one, and the town of Sydney, two. With any change in the numerical strength of the council, the ratio of one-third and two-thirds between the nominated and the elected members was to be observed. Of the 12 nominees six at least were to be non-officials. Councillors were to possess freehold worth £2000 or returning £100 in annual income. A speaker was to be elected from and by the members (Alexander Macleay, q.v., was the first). The governor, who thus ceased to preside over meetings of the council, could still instruct it to consider measures and amendments, but it obtained the right to initiate legislation without his intervention. Its maximum lifetime was five years, though it might be dissolved sooner; it must be summoned for at least one session each year. It was also given the power of imposing customs duties, but was not allowed to fix differential rates as between one country and another; duties were collected by officers responsible to the home authorities, and the appropriation of revenue was made on the governor's recommendation.

This act was a further step away from autocracy and towards democracy. The governor's constitutional influence was considerably weakened; but he was still his own prime minister, appointed and dismissed at pleasure the heads of departments, could dispose of crown lands and the proceeds from the sale thereof, introduce financial measures, exercise an independent control over the finances, and veto the council's measures. In short, executive officers were independent of the legislature, and the main tenet of the system of responsible government was thus unrecognized. The newly-constituted legislative council met for the first time on 1 August 1843.

The same act made provision for the establishment of district councils, to consist of from 8 to 21 members according as the population of the district varied from 7000 to 20,000 and upwards. In addition to the usual functions of a municipal body, these councils were to provide half the cost of police maintenance, though they had no control over the police. The governor could collect the amount, if necessary, by distress and sale of the property of district treasurers, councillors and inhabitants of the district. This scheme of local government provoked widespread opposition, and was never fully brought into operation, the whole of the police-fund being provided annually by vote of the legislative council from the general revenue.

Further dissatisfaction with Earl Grey's attempt to foist another local government scheme on the colonies, together with the desire of Port Phillip for separate political existence, resulted in an enquiry by a specially constituted committee of the privy council on trade and plantations. The outcome of its recommendations was the act of 1850 'for the better government of her Majesty's Australian colonies' (13 and 14 Vic. cap. 59), which provided for the erection of Port Phillip district into a separate colony, the establishment of legislative councils in Tasmania, South Australia, and Western Australia, and an increase of legislative powers for New South Wales, including the power to impose customs duties to take effect without awaiting the Queen's assent. The franchise was liberalized, freeholders of property worth £100 and householders paying a rental of £10 being enfranchised. But, as experience proved, the most important clause was that empowering the council to amend the constitution so as to provide for a bicameral legislature. The governor of New South Wales also received commissions as captain-general and governor-general of all the Australian possessions, and as governor of New South Wales, Tasmania, Victoria, and South Australia—the actual governors of the last three colonies being in name merely lieutenant-governors. This federal experiment was abandoned in 1861. District councils were rendered more acceptable by placing their establishment on a voluntary basis, and by relieving them of the expense of the police establishment.

Hitherto we have been dealing with the whole of eastern Australia. We now discuss the constitutional history of New South Wales within its present limits. Here the act of 1850 gave little satisfaction, because (1) the council's control over matters of revenue and expenditure was not yet complete, (2) the British government still interfered in appointments to colonial positions, and (3) the legislature still lacked control over the executive. A 'declaration and remonstrance' was in May 1851 drawn up by the legislative council at the instance of W. C. Wentworth, and forwarded to Downing-street. In reply Sir John Pakington, the new secretary for the colonies, encouraged the colonial council to draft a constitution for itself. Select committees in 1852 and 1853, with W. C. Wentworth as chairman, did so without delay, and an act to confer a constitution on New South Wales received the royal assent on 16 July 1855. By it a bicameral parliament was constituted, with an elected legislative assembly of 54 members in the first instance and a nominee legislative council of not fewer than 21 members; at least four-fifths of the councillors must be non-officials. The franchise was conferred on residents of six months' standing with freehold property worth £100, rent-payers of £10, and persons paying £40 a year for board and lodging. The duration of parliament was limited to 5 years. All appropriations of revenues, including proceeds from crown lands, were controlled by this legislature, the assembly determining both taxation and appropriation. Henceforth, therefore, ministers of the crown were responsible to the legislative assembly. Britain still forbade the levying of differential customs rates, but this embargo was finally lifted in 1873. The purity of justice was safeguarded in the usual way by the appointment of judges for life. The first parliament under the new constitution met on 22 May 1856 to elect a speaker, and was ceremonially opened on the 23rd with Stuart Donaldson as the first premier.

Since 1856 the following modifications in the constitution have been effected:—(1) In 1857 simple majorities of the assembly, instead of two-third majorities, were made sufficient to effect constitutional amendments. (2) In 1858 the secrecy of the ballot box was introduced. (3) In

1874 the duration of each parliament was limited to three years. (4) Manhood suffrage and the principle of 'one man one vote' were adopted in 1893. (5) The franchise was extended in 1902 to women, who, however, were debarred from entering parliament. (6) In 1912 provision was made for a second ballot; whenever more than two candidates were nominated, and the candidate at the top of the poll did not receive an absolute majority of the votes recorded, a second poll was taken between the two most favoured candidates. (7) In 1918 the State was broken up into 24 large electorates, each returning three or five members, and a system of preferential voting was adopted. At first it was necessary to vote (in order of preference) for all candidates indicated on the voting paper, but since 1921 it has been sufficient to vote only for the number of candidates to be elected. Electors absent from their electorates may vote at any polling-booth in the State, and postal voting is allowed to the ill and infirm. A casual vacancy occurring between two general elections is filled by the unsuccessful candidate next on the poll who represents the same party as the member vacating the seat; when no such candidate is available, the leader of the party concerned nominates the successor. Enrolment as an elector is compulsory, voting is not. The electorates are redistributed every nine years, or sooner if the government so directs. Since 1916 public servants have been allowed to stand for election without resigning their positions, though resignation must follow successful election. Women have been eligible for election since 1918, but up to the end of 1924 none had been elected.

The numerical strength of the assembly has varied. In 1856 it was 54; 72 in 1858; 108 in 1880, with provision for automatic increase as the population grew, so that in 1891 there were 141 members. In 1893 the number was reduced to 125, and in 1901 (after federation) to 90. Members of the assembly have been paid, since 1889, at the following rates:—from 1889 to 1912, £300 a year; in 1912 and onwards, £500; in 1920-21, £875; since 1922, £600. The premier receives £2000; attorney-general, £1600; other ministers, £1500; speaker, £1400; chairman of committees, £840. The members of the council, whose number is unlimited (there were 75 in 1924), are unremunerated, but the president receives £925 and the chairman of committees £500.

In 1788 New South Wales comprised all the continent east of the 135th meridian; in 1825 the boundary-line was shifted west to the 129th meridian, the present boundary of Western Australia and South Australia. In the same year Tasmania was constituted a separate colony; this had been provided for in the act of 1823. Western Australia was formally annexed in 1829, South Australia was carved out of New South Wales in 1836, Victoria in 1851, and Queensland in 1859. South Australia was enlarged in 1862 by the addition of the narrow strip between the 132nd and 129th meridians. In the same year the detached northern portion of New South Wales was divided, all east of the 138th meridian being handed over to Queensland; and in 1863 the remainder of this detached area, thenceforth to be known as the Northern Territory, was placed under the jurisdiction of South Australia, which in 1911 transferred it to the federal government. (See COLONIES, CREATION OR SEPARATION OF.)

TASMANIA.—From its settlement in 1803 to 1825 Tasmania was under the jurisdiction of the governor of New South Wales, with a lieutenant-governor acting under instructions. When separated in 1825 it was given its own legislative council, executive council, and supreme court, all on the New South Wales pattern. In 1850 it was granted a partially elected council, such as had been granted to the mother-colony in 1843. Responsible government was established in 1856. Tasmania's bicameral system of legislature varies from the normal type in that both council and assembly are elected. The council consists of 18 members, who must be at least 30 years old, elected by owners of freehold worth £10 a year, professional men, naval and military officers, and university graduates and associates. Three councillors retire annually, so that the council as a whole is never dissolved. The assembly of 30 members is elected by adult suffrage; the State is divided into five electorates, each returning six members, who are elected on a slightly modified Hare-Clark preferential system of voting. Members of both houses receive £300 a year, the premier £1200, other ministers £1000 each, and the president of the council and speaker of the assembly £500 each. A remarkable development of parliamentary government occurred in Tasmania on 1 December 1924, when the acting-governor (Sir Herbert Nicholls) on the advice of the crown law officers assented to the appropriation bill in the form in which it passed the house of assembly, ignoring amendments made in it by the legislative council. The colonial office, appealed to beforehand, merely assured the acting-governor that his action was not unconstitutional, responsibility resting on his ministers.

WESTERN AUSTRALIA.—The first British settlement on the western side of the continent was effected in 1826, when a military establishment was made at King George's Sound. Three years later a community of free settlers was founded at Perth with Stirling as lieutenant-governor. At first the governor was assisted by an executive council of four officials. In 1831 these five also constituted the legislative council, but eight years later four non-official members were added. An Imperial act of 1850 provided that the colony might establish a legislative council of the old two-thirds elected type; but this involved the cessation of grants from Britain and the assumption by the colonists of all the expenses of government. The price was too high, and no advantage was taken of the act until 1870. In 1867-8 the composition of the legislative council was altered to six nominated officials and six non-official members nominated by the governor, after election (on a free-manhood suffrage basis) by six districts into which the colony was divided. In 1870-89 the legislature was partially elective, 12 members being elected by owners of £50 of freehold and householders paying £10 yearly, and six being nominated by the governor. The paucity of population delayed the granting of bicameral responsible government till 1890. At first the council was nominated; from 1893 onwards it consisted of 21 members elected by freeholders, householders, lease and licence holders. The numbers have been altered from time to time: at present (1925) 30 councillors, each at least 30 years old, are returned by ten electorates for a period of six years, one-third retiring in rotation biennially. The assembly, which in 1893 had 33 members, now consists of 50 members returned by single-member electorates on a system of contingent or preferential voting. Since 1920 women have been eligible for election to either house, and one woman has been elected to the assembly.

Women have exercised the franchise since 1899. Members of the legislature receive £400 a year, the president of the council and speaker of the assembly receiving £700, the premier £1500 and other ministers £1300.

SOUTH AUSTRALIA.—For some time after the foundation of this colony in 1836 the control of land and the revenues from land were placed in the hands of a board of colonization commissioners, other matters being administered by the governor. In 1842, however, South Australia became a crown colony of the ordinary type, the governor controlling the whole administration with the aid of a nominee council of seven members, three officials and four non-official persons. The first council was called together in October 1843. The right to elect some members was granted in 1851, when a council of 24 members (16 elected, 8 nominated) was created. In 1856 responsible government under a bicameral legislature was established. The council consisted of 18 property-owners, each at least 30 years old, elected for 12 years, one-third of the number retiring every fourth year; in 1902 the term was reduced to six years, one half (nine members) retiring triennially. Since 1913 there have been 20 members elected by five districts. The first assembly consisted of 36 members from 12 electorates: in 1875 22 electorates returned 36 members, in 1882 26 returned 52, and from 1888 onwards the Northern Territory also elected two members. In 1902, after the accomplishment of federation, the numbers were reduced to 42 members for 13 districts. Since 1913 46 are elected from 19 constituencies. Between 1887 and 1921 members of the legislature received £200 a year, but on 1 December 1921 the amount was increased to £400: the president of the council and speaker of the assembly receive £800, and ministers divide £7750 between them. The assembly was based from the first on manhood suffrage, and after 1894 on universal adult suffrage, South Australia being the first colony to adopt woman suffrage. Since 1856 parliaments have been triennial. In case of a deadlock between the houses—i.e. should the council in two successive parliaments reject a measure sent up from the assembly—the governor may either dissolve both houses or make additional appointments to the council.

VICTORIA.—The settlement at Port Phillip was in 1843-51 represented in the partially elective legislative council of New South Wales, five members being elected by the district and one by Melbourne. The act of 1850 provided for the erection of Port Phillip into a separate colony, with its own legislature, and the issue of writs on 1 July 1851 for the election of a Victorian legislative council marked the separation. Provisional arrangements made by the New South Wales council constituted 16 electorates to return 20 members—three to represent Melbourne, two for Geelong, three for other towns, three for the settled districts of Bourke and Grant, five for intermadite districts, and four for pastoral districts; to these were added ten members nominated by the governor. In 1856 responsible government with a bicameral parliament was granted; the council (which was elected) consisted of 30 members, each at least 30 years old, possessing freehold to the value of £5000 or returning £500 per annum, members holding their seats for ten years. The 60 members of the assembly were elected for five years (after 1857 under manhood suffrage); they must possess a freehold worth at least £2000 or returning £200 yearly. The qualification for council electors was for many years high; but now an owner of freehold with a rental value of £10, a leaseholder or tenant paying £15 rent, university graduates and matriculated students, members of the legal, medical, ecclesiastical, and teaching professions, and officers of the army and navy are entitled to vote, and in 1909 the franchise was extended to women under the same conditions. The present council, which between 1856 and 1902 grew to 48 members, now consists of 34 members elected for six years from 17 districts, one half retiring triennially. A council elector may be enrolled in respect of residence for one district, and in respect of freehold property for another, but it is difficult for him to vote twice because of the size of the electoral districts; further, voting by post (which has been allowed since 1900) does not permit of a dual vote. The assembly consists of 65 members returned by single-member electorates under adult franchise. In 1903 the over-great influence of public servants with a vote led to their segregation from the residential constituencies: railway employees were given two representatives, and other public servants one in the assembly, and one representative in the council was assigned to the whole public service. The experiment proved unsatisfactory, and was abandoned in 1906. Preferential voting was adopted in 1911. Special provision has been made for a simultaneous dissolution of both houses when the council twice rejects a measure passed by the assembly in consecutive parliaments. The council may suggest amendments to appropriation bills at three stages: (1) when the bill is in committee, (2) in the report of committee, (3) during the third reading. The ministry is limited to eight members, not more than six being appointed from the assembly; not less than four must be members of one or other of the houses, so that it would be constitutional to have four non-members of parliament in the ministry—in actual practice this provision has been ignored. A minister who is a member of the assembly may attend council meetings to explain government measures, but cannot vote in that chamber. Members of the assembly are paid £500 a year, councillors since 1922 £200 a year; the president of the council receives £750, the speaker of the assembly £1000, the premier £1600, and other ministers £1200.

QUEENSLAND.—The 'Northern District' of New South Wales, which included the Moreton Bay and Darling Downs settlements and stretched as far south as Port Macquarie and the upper Hunter valley, was after 1843 an electoral district; but in 1851 Moreton Bay was sufficiently populated to be granted a member of its own, and by 1858 nine members represented districts north of the Clarence. On 6 June 1859 the colony of Queensland was constituted by letters patent, under authority of the acts of 1842 and 1855. The first Queensland parliament met on 22 May 1860. The constitution of the colony was based largely on that of New South Wales, with a nominated council and an elective assembly. The provisions of the New South Wales constitution act of 1853 (which provided for a nominated council and an elective assembly) remained in force in the new colony until 1867, when a separate constitution act was passed, chiefly as a consolidating measure. In 1886 Samuel Griffith passed a members' expenses act, thus laying the foundation for the payment of members act of 1889, which provided members with a salary of £300 per annum. Several attempts were made to reform the legislative council. In 1908 the legislature repealed a proviso necessitating a

two-thirds majority in each house for bills amending the constitution, and in the parliamentary bills referendum act provided for the submission to electors of any bill passed in two succeeding sessions by the assembly and rejected by the council. In 1915, 1916-17, and again in 1918 bills providing for the abolition of the legislative council were passed by the assembly but rejected by the council. In 1921, however, the act was passed, and came into operation in 1922. Since 1910 the assembly has consisted of 72 members, elected by single-member electorates on an adult suffrage basis. A modified system of preferential voting has been adopted. On 22 August 1922 members of the assembly were given the right to vote by proxy, so that a ministerial majority is never endangered by the absence of any of its members. Parliaments were quinquennial up to 1890, triennial since. Members receive £500 a year, the speaker £1000, the premier £1300, and other ministers £1000. Whereas in the other States members of parliament are given free passes over the State railways to enable them to visit their constituencies, in Queensland—where much of the travelling must be done by steamship or coach—members are reimbursed their travelling expenses.

THE COMMONWEALTH.—In 1901 the constitutions of all the Australian colonies were modified by removing certain powers from the ambit of each colonial legislature and entrusting them to a new legislature elected by the Australian people as a whole. The methods by which this change was accomplished, and the general history of the movement towards federation, are recounted under FEDERATION. The nation formed by thus uniting the populations of the six colonies was named 'The Commonwealth of Australia,' and the several colonies became 'States' of the Commonwealth. Its constitution may be examined under the following six headings:—(*a*) the executive, (*b*) the legislature, (*c*) the division of powers, (*d*) the judiciary, (*e*) provisions for amendment, (*f*) Imperial connections.

The Executive.—The federal executive power is vested in the sovereign of Great Britain, and is exercised by his representative the governor-general, who summons, prorogues, and dissolves parliament, may withhold his assent to bills whenever Imperial interests demand it, and at times of political crisis may exercise his own discretion whether to dissolve parliament or to select new advisers. In this respect he has actually greater powers than the King, who invariably acts in this matter as in all others on the advice of his ministers. Of late years this exercise of personal discretion has somewhat fallen into disuse, but it is not obsolete (see Keith's *Responsible Government in the Dominions*, pp. 180-211). In other matters the governor-general acts always on the advice of his ministers, who are collectively responsible to the federal lower house for their administration. Under the constitution act of 1900 a ministry must not consist of more than seven members, whose remuneration must not exceed £12,000 in all. But in 1915 and 1917 the maximum number was increased to nine and the remuneration to £15,300, of which the prime minister receives £2100. The executive at present includes a prime minister, treasurer, attorney-general, postmaster-general, vice-president of the executive council, and ministers for home and territories, defence, works and railways, and trade and customs. There are also two honorary ministers, who assist the more overburdened of the others.

The Legislature consists of the King (represented by the governor-general), the senate and the house of representatives. The senate is nominally the States house, in that the principle of the equality of States is recognized in the election of members. Each State, irrespective of its population, elects six representatives on a basis of manhood suffrage, the object being to safeguard the interests of the smaller States. They are elected for a term of six years, one half of their number retiring every three years—an attempt to secure continuity of policy and provide against sudden radical changes. For senatorial elections each State forms a single constituency. The house of representatives is based on the principle of equality of electors, members being allotted to each State in proportion to its population. The quota (number of electors whom each member should, approximately, represent), obtained by dividing the total population of the Commonwealth by twice the number of senators, is itself divided into the State population to ascertain the number of representatives for the respective States. Nevertheless, as no State may be represented by fewer than five members—and Western Australia would by mathematical calculation be entitled only to four, and Tasmania to three—the total strength of the house of representatives is 75 or somewhat more than twice the strength (36) of the senate; New South Wales sends 28 members, Victoria 20, Queensland 10, South Australia 7, Western Australia 5, and Tasmania 5. In addition, the Northern Territory sends a representative to the lower house, with power to participate in the debate but not to vote. The house of representatives is elected for three years at most; every qualified elector is also eligible as a candidate. The powers of the two houses are co-ordinate, except that bills appropriating revenue or imposing taxation must originate in the house of representatives. The senate has power to accept or reject *in toto* such measures, but not to amend them, though it may 'suggest' amendments. In case of a deadlock between the two houses—that is, when the senate has twice rejected or insisted on hostile amendments in a measure that has passed the house of representatives—the governor-general may dissolve the two houses if an election is not due within six months. If after the subsequent election the difference between the two chambers continues, a joint sitting is held, and the numerical superiority of the house of representatives over the senate gives the former an overwhelming predominance. Members of both houses receive £1000 a year, the president of the senate £1900, and the speaker of the house of representatives £1900.

Division of Powers.—The federal parliament is empowered to make laws with regard to certain specified matters, namely, foreign and inter-State trade and commerce (but not intra-State trade), customs and excise, bounties on exports and goods produced within the Commonwealth, borrowing on Commonwealth credit, postal, telegraphic and telephonic matters, defence, lighthouses, meteorological and astronomical observations, quarantine, fisheries beyond territorial limits, census and statistics, banking and insurance, weights and measures, exchange and promissory notes, bankruptcy, copyrights, naturalization, marriage and divorce, foreign corporations, invalid and old age pensions, civil and criminal processes, immigration and emigration, external affairs, the Pacific islands, railways for defence purposes, conciliation and arbitration in disputes extending beyond the limits of a single State.

The federal authorities must allow absolute free trade between the States, and customs duties must be uniform throughout the Commonwealth.

The State legislatures still exercise powers not specifically enumerated as federal in the constitution. They still control public lands and works, intra-State trade and industry, justice, the railways, education, and local government. The States cannot raise military or naval forces, or coin money, or tax federal property; the Commonwealth cannot tax State property. In the imposition of customs provision was originally made (see BRADDON CLAUSE) for the return of three-quarters of the revenue to the States. Since 1910 the States have received, in lieu of this, 25 shillings per head of population. Provision is made in the constitution for the transfer of State debts to the Commonwealth, but this has not yet taken place. Trade and commerce were placed under an inter-State commission in 1912.

The Judiciary.—The federal judicial power is exercised by a high court consisting of a chief justice and several puisne judges (at first two and later six), who are rendered independent of political pressure by being appointed for life at a salary fixed and irreducible during their term of office. It has appellate jurisdiction (1) against the decision of any of its own justices exercising original jurisdiction, (2) from other federal courts, the supreme courts of the States and other State courts, (3) from the inter-State commission. The high court's decision is final, except that appeal may be made to the King in council when the King (i.e. the judicial committee of the privy council) or high court itself gives its sanction. It has also original jurisdiction in matters (1) arising under a treaty, (2) affecting consuls or foreign representatives, (3) in which the Commonwealth sues or is sued, (4) between States, or residents of different States, or a State and a resident of another State. It is also the 'guardian of the constitution' and tests the validity of Commonwealth or State laws by reference to the federal constitution whenever a State or individual appeals for such a decision.

Amendment of the Constitution.—The federal constitution is of the 'rigid' type—that is, it cannot be amended by any ordinary process of legislation. Section 128 ordains a method of amendment much hedged in by restrictions. In the first place an amending act must be passed by an absolute majority of each house of parliament. If either house refuses to accept unaltered an amending bill twice passed by an absolute majority of the other house, the bill so passed is treated as if it were an act. In the second place, the act (or bill) must be submitted by referendum to the electors not less than two or more than six months after being passed as aforesaid. In the third place, the referred proposal must be accepted by (*a*) a majority of all the electors voting, (*b*) a majority of the States. Furthermore, any amendment affecting the provisions of the constitution in regard to any particular State (e.g. altering its proportionate representation, or affecting its territorial limits) must also be accepted by a majority of electors voting in the State affected.

Imperial Connection.—The Commonwealth and the States are connected with the British Empire by means of the following links:—(1) The governor-general is appointed by the British government. (2) The governor-general in the first instance, and the King (even when his representative has given assent to a bill) have the right of veto. (3) State governors are appointed by the British government, thus indicating the greater independence of Australian States as compared with Canadian provinces. (4) The amending power lies with the parliament and people of Australia, but the home parliament has a nominal right to amend. (5) Appeals may be made from the high court to the privy council. (6) Great Britain still undertakes the ultimate responsibility of defence and control of foreign policy, though of late years the powers of the Dominions in these respects have somewhat expanded. (7) Australian parliaments cannot annex territory unless the crown specially delegates to them the power to do so. (8) The British parliament claims the right to make laws binding on the whole Empire, but on all matters of common concern the Dominions are consulted, principally through the medium of Imperial conferences (q.v.).

K.R.C.

Convicts. This article, which is concerned solely with the convict after his landing in Australia, should be read in conjunction with that on TRANSPORTATION, which deals with his sentence, term of imprisonment in England, and passage out.

By two orders-in-council dated 6 December 1786 the eastern coast of Australia, and the adjacent islands, were appointed places to which offenders could be transported oversea from Britain; and it was with the despatch of 696 convicts in the 'First Fleet' (q.v.) in 1787 that the English occupation of Australia was initiated. Despite protests which grew stronger and stronger as years went by, and had at least the result of restricting the area in which this 'dumping' was permitted, the process was continued until 1867. During that period the total number of persons sent under sentence to Australian shores amounted to 160,663, of whom New South Wales between 1788 and 1841 received 83,290, and Tasmania (1803-1852) 67,655; Western Australia in 1850-1867 received 9718, all males. So long as convict labour was felt to be an economic necessity, the reception of the transported had been taken as a matter of course; but, when the colonies had developed into large and self-sufficing communities with a large free population, and had become jealous of their standing and reputation in the civilized world, the system could no longer be tolerated.

Of the 696 convicts who formed the first contingent to New South Wales, 192 were women. During the whole transportation period, there was a similar (or even a greater) disproportion of the sexes. Of about 100,000 transported up to 1836 only 13,000 were females. This fact not only accounts for the low birthrate during the early period, but has an important bearing upon the amount of 'convict blood' inherited by later generations. The suspicion of a 'taint' is in any case grossly exaggerated by those who underestimate both the number of free settlers even in convict days, and, still more, the overwhelming influx of immigrants of a high type who have arrived since the system became part of ancient and half-forgotten history. Thus, in New South Wales alone, during the years 1861-1915 there arrived some 443,000 immigrants; indeed, except for internal migrations, most of the present States have been almost entirely peopled by such settlers.

The treatment of the first arrivals, though expatriated as 'the very dregs of society,' was, relatively to the times, unusually humane. This fact was due to the first governor, Captain Phil-

lip, who, though capable of severe disciplinary and deterrent measures, held enlightened views as to the prospect of a moral and industrial rehabilitation of his charges. Not only did he release them from their chains on the voyage out; on the day of formally establishing his government on land, he assured them of opportunities and assistance in any endeavours they might make to improve their position by conscientious work and good behaviour. On the other hand he hanged two ringleaders of a mutiny on board ship, and at a later date (1789), when the scanty and vitally necessary stores of the settlement were plundered, he summoned a court, hanged the ringleader, and committed the rest of the robbers to imprisonment on bread and water on a little island in Port Jackson which thus earned the appropriate name 'Pinchgut;' it was afterwards used for defence purposes, and is now known as Fort Denison. In spite, however, of these humane tendencies on the part of Phillip and of some, at least, of the later governors—such as Macquarie and Bourke—the treatment of convicts was marked, throughout almost the whole of the transportation period, by excessive rigour and frequently by flagrant brutality. For this there were several causes. The prevailing notion of the times was that the harsher the punishment the greater the deterrent, and that corporal punishment was the most effective; what would now be considered minor offences were then regarded as serious crimes; the situation of the community was one which called for safeguarding by rigorous discipline; officers and overseers were often petty tyrants of a merciless type; and, it must be added, many of the convicts were practically irredeemable criminals or incorrigible idlers.

The infant community consisted of the convicts, a military guard, and the officers of the government. To these there were gradually added a number of free settlers. In the earliest days it was difficult to maintain the colony in bare existence; it could not produce sufficient food-supplies for its own support, and shortages of provisions were often occasioned either by official neglect or by the delays and disasters of ships. These circumstances, combined with the severity of the punishments and the lawless temperament of many convicts, led to frequent outbreaks of insubordination, robberies, and daring attempts at escape. Several such attempts were successfully made in the early part of 1791. Apart from endeavouring to reach Java by sea, a strange notion prevailed among the prisoners that China could be reached by a journey overland, and the commissary's report for 1792 states that, of the number who deserted the settlement to seek that country, 44 men and 9 women had disappeared to perish or wander in the bush. Other escapees stole vessels from their anchorage, and, though some were recaptured, others became pirates or roamers in the South Seas.

During this period the work performed by the convicts was mainly building, clearing and cultivating, chiefly in the neighbourhood of Parramatta. In the agricultural domain the labour was not too exacting. In 1792 Phillip writes that the hours are only from 5 to 9 o'clock in the morning and from 4 to half-past five in the afternoon. In other respects attempts were made towards a normal life. Convicts and ticket-of-leave men were encouraged to marry. 'Emancipists' (q.v.) and expirees were permitted to take up small blocks of land for their own use. In this manner many 'first fleeters' settled along the newly discovered Hawkesbury River. Meanwhile free settlers were encouraged to apply to the government for the services of convicts, and of the women so engaged, originally as domestic servants, some became the wives of the male servants. Nor were convicts always kept at arm's length by the free. Thus they were permitted to join in public celebrations, and on the King's birthday in 1789 the first play performed in Australia (Farquhar's *Recruiting Officer*) was enacted by convicts (see DRAMA). The conditions of the convict system after the departure of Governor Phillip varied with the character of the governor, the supervision of the home authorities being necessarily nominal. The insufficiency of the information which they obtained made necessary the appointment of special committees in 1812 and 1837, and of a commissioner in 1819, to investigate the system in operation; and their reports, supplemented by official and private correspondence, give a fairly clear idea of the conditions under which convicts laboured until the end of the thirties.

The normal proceedings on the arrival of a transport in Sydney harbour were as follows. The convicts were first classified, not according to their previous record of character (except in so far as the surgeon superintendent might make such report), but according to their age and trade. As late as 1834 Bourke complained of the complete absence of data, apart from length of sentence, on which a proper classification might be made; he therefore welcomed an announcement from the colonial office in that year to the effect that a revision of the system in this regard, including classification in England, was contemplated. But about that time there were four political heads of the colonial office in 18 months, and the proposed revision was forgotten. Mechanics were generally reserved for government employ, and as many other convicts as might be required for public works. In Sydney before 1819—when the convict barracks were constructed—there existed no public place for lodging or temporary confinement of male prisoners on government work, and they were therefore released from service at 3 p.m. to find means to pay the expenses of private lodging. After the establishment of the barracks, government convicts who were still permitted by reason of good conduct or family ties (594 in 1819) to have private lodgings were obliged to work the full day, but were free on Saturday. Their clothes and food were provided by government; after the first years of shortage these were sufficient and good. The chief spheres of employment of such convicts were on public works, in the marine and survey departments, in the constabulary, in the households of government officials, and at the agricultural establishments, of which there were three under Macquarie—Grose Farm (now the site of the university of Sydney), with accommodation for 160 men and boys; Longbottom (between Sydney and Parramatta) with 110 men; and Emu Plains with 269. The convicts were lodged in wooden or bark cottages, each being permitted to build a separate one for himself. Convicts in government employ were generally divided into gangs, each with an overseer; every two or three gangs had a superintendent, frequently chosen from amongst the best-conducted convicts.

Convicts who were not taken into government service on arrival were either given tickets of leave or assigned to settlers. Tickets were usually granted to persons who had been in a 'higher station in life,' and had means of supporting themselves privately; they were obliged to pre-

sent themselves periodically before the magistrates, but were otherwise free to work on their own account. Convicts assigned to settlers were clothed, supported, and lodged by them; they worked either 'by the task' or for the same number of hours as the government convicts, and when the set labour was finished were allowed to work on their own account. Those assigned to well-to-do settlers were usually employed by their masters during their free hours at a rate of pay fixed by regulation; those assigned to poorer settlers, who could not afford to pay for extra time, were usually obliged to seek employment in the neighbourhood—a practice which led to irregular habits and discontent. In 1838 in New South Wales an assigned convict was entitled to a weekly ration of 12 lb. of wheat (or its equivalent in flour); 7 lb. of mutton or beef or 4½ lb. of salt pork; 2 oz. of salt, and 2 oz. of soap. For clothing the annual dole was 2 frocks or jackets, 3 shirts, 2 pairs of trousers, 3 pairs of shoes, and a hat or cap. In Tasmania the allowance was somewhat more liberal. Sir William Molesworth was told by a settler that he had assigned to him four convict servants, one transported for forgery, one for burglary, one for attempted murder, and one for a bestial offence. The welfare of the assignees depended upon the character and temper as well as upon the social position and occupation of the master. The inevitable inequality in their lot was emphasized by both Bourke and Gipps. Bourke, denying the charges made in England that their life was 'one of ease and plenty,' wrote: 'Although the condition of the convict is that of a slave, it has not been thought desirable to give to the master a power of personally inflicting punishment; a most extensive summary jurisdiction is, however, given to the magistrates, who (with the exception of those who are stipendiary) are always themselves settlers directly interested in maintaining the strictest subordination, and in exacting the most laborious exertion which the law permits on the part of the assigned servant.' Bourke did impose restrictions on magistrates in respect of the number of lashes which they might inflict, but the result was a petition from a number of landowners and magistrates to the King against such leniency. He also incurred hostility by establishing a board for the more equitable distribution of convict labour, and by his readiness to receive petitions from convicts as well as from settlers. On the other hand, in the service of humane masters the lot of the assignee was as happy as the system would allow. Gipps, for his part, declared that assignment was 'the greatest and the worst of lotteries.'

Female convicts on arrival were given tickets of leave—if they had husbands in the colony, or other means of supporting themselves and any children dependent on them—or assigned as domestics to officials or settlers, or sent to the factory at Parramatta. Before 1819 the condition of the factory was most unsatisfactory. Accommodation was provided for less than a third of the women sent to the town, and the remainder were obliged to find lodgings privately, frequently by cohabiting with male convicts or poorer settlers. In 1812 Macquarie had suggested that work at the factory should be much extended to accommodate more of the women, whom it was sometimes difficult to place, and proposed that a new factory should be erected. This factory, built in 1819, was inefficiently managed until the mid-thirties and had, as the select committee of 1837-8 pointed out, more of the character of a lying-in hospital than of a prison or a reformatory. Before his departure for New South Wales Gipps was authorized to reorganize the management, and soon after reaching the colony he made provision for separate confinement and for the introduction of industries. The dressing, and manufacture into nets, of New Zealand flax was introduced but abandoned, owing to the lack of a market for the product; needlework and washing for private persons (as well as on government account) was also organized, and the convicts were permitted to retain part of the money earned by their work as an encouragement to good behaviour.

There were, of course, wide differences of character among the convicts. The report of the select committee of 1837-8 referred to convicts in general as 'the very dregs of society,' and all the witnesses agreed that the conduct of the females was 'as bad as anything could well be.' On the other hand John Hunter—who had been a governor—told the committee of 1812 that 'there are many men who have been convicts, and are now settlers, who are as respectable as any people who have gone from this country.' Well-conducted convicts usually obtained a ticket of leave after 4, 6, or 8 years, if their original sentences had been for 7 years, 14 years, and life. If they married and showed themselves able to support a family, tickets of leave were granted more freely, and they had little difficulty in obtaining good wages, often with the government as constables, overseers, etc. Emancipation, too, was within reach of those worthy of it (see EMANCIPISTS). On the whole, however, the system was not conducive to moral regeneration. At its worst, as Molesworth said, 'it degraded the human being into a brute, destroyed his reflecting powers and left him no other thought or wish but the immediate gratification of his appetites.' Drunkenness, neglect of work, and theft were common. Concerted action among the convicts was always to be feared, though the lack of cohesion among them usually frustrated any planned riots. The only serious outbreak in New South Wales was that in 1804 among the Irish political prisoners, who had a legitimate grievance in that the records of their convictions were not forwarded to the colony. The trouble at Bathurst in 1830 was an ebullition of convict bushrangers (see BUSHRANGING), rather than an organized rebellion. Attempts at escape were less frequent than might be expected—owing, no doubt, to the fate that usually befell escapees. In Tasmania, for instance, between 1822 and 1827 116 convicts absconded from Macquarie Harbour; and of these 8 are known to have been murdered, 6 eaten by their companions, 16 hanged for murder or bushranging, and 2 shot by the military. Most of the others are supposed to have perished in the wilds.

Whatever the offence, punishment was immediate and severe. The lash was its most frequent instrument, and flagellations at the triangles were brutal in the extreme. Hardened assigned servants were returned to the government, and were then either worked in chain-gangs or sent to a penal settlement. The first penal settlement to which convicts were retransported for offences committed in the colony was Norfolk Island; when in 1806-7 it was temporarily abandoned, they were sent either to Tasmania or to the Hunter River—where they worked at lumbering, or procuring lime from sea-shells, or in the much dreaded coal-mines. The Hunter River station had its disadvantages as a place of punishment. It was the obvious destination of

convicts who had had mining experience in England, whether or no they were reconvicted in the colony; coal-mining suffered if only hardened offenders were set to the work, and the experienced miners suffered unjustly if they were intermingled with reconvicted men. When free settlement began to extend along the Hunter, it was found necessary to occupy Port Macquarie (1821) as a penal settlement for reconvicted offenders. Commissioner Bigge suggested an improved method of convict classification, and proposed that only convicts of good character should be left in the settled districts, the rest being moved to a new settlement at Moreton Bay, Port Curtis, or Port Bowen. The retention of the settlement at Port Macquarie was in his opinion a hindrance to the development of its rich hinterland by free men. The colonial office preferred the reoccupation of Norfolk Island to the establishment of fresh penal settlements on the New South Wales coast, but Governor Brisbane pointed out that, if Port Macquarie was to be abandoned, the island was not big enough to contain all who under the new classification must be removed from New South Wales. In 1825, therefore, he developed a scheme by which Port Macquarie would be the prison for those guilty of 'first grave offences; Moreton Bay for runaways from the former, and Norfolk Island as the *ne plus ultra* of Convict degradation.' Earl Bathurst, adhering to Bigge's opinion, proposed in 1826 to occupy the shores of Shark Bay on the western coast as a prison for offenders in the second stage of Brisbane's scheme, making Moreton Bay the first stage, and leaving Port Macquarie open for free colonization: and, though the occupation of Shark Bay did not materialize, Darling managed, by withdrawing the lesser criminals to serve in road-gangs, to empty Port Macquarie until the remnant could be shifted without inconvenience to Moreton Bay. This process was completed in 1830, and reconvicted women who had formerly been sent to Port Macquarie were now sent to Moreton Bay until 1839, when the female establishment there was broken up preparatory to the removal of all convicts from that centre (see BRISBANE). But although settlers were now allowed to occupy land in the neighbouring district, the station at Port Macquarie was not altogether disused; Governor Bourke at first sent to it all educated convicts as they arrived in the colony, and afterwards (about 1835-6) used it as a reformatory 'out of the way of harm' for 'persons of feeble bodily health or incorrigible petty thieves.'

Meanwhile in Tasmania Governor Sorell had in 1818 employed Macquarie Harbour for the reception of reconvicted persons and Arthur in 1832 moved this settlement to Port Arthur. The conditions in Norfolk Island and Port Arthur, to which the worst type of male convicts were sent, are described as being of unmitigated severity. In these penitentiaries there were no other inhabitants than the prisoners and their guards and keepers, and none but official communications were permitted with the settled districts. No female convicts were sent there. The work was of the most incessant and galling description, and the lash and irons were in frequent use. It was considered unsafe to trust the men with knives, and they must perforce tear their food with their fingers. When not actually at work, and during the whole of Sunday, they were confined in a yard surrounded by a high wall. The moral condition of the prisoners was atrocious. Styles, a resident chaplain at Norfolk Island, officially reported that 'blasphemy, mutual hatred, and the unrestricted indulgence of unnatural lust are the things with which a short residence in the prison wards must necessarily familiarise the convict.' In the opinion of Chief Justice Forbes 'the experience furnished by these penal settlements has proved that transportation is capable of being carried to an extent of suffering such as to render death desirable, and to induce many prisoners to seek it under its most appalling aspects.' A similar statement was made concerning Norfolk Island by Dr. Ullathorne (q.v.). Bourke reported on 5 November 1837 that much of the atrocious crime prevalent at the island during the early thirties was due to the hope the criminal entertained of being taken to Sydney for trial; when it was made possible for the authorities to try capital offences on the island itself, conditions became quieter. Arthur also mentions prisoners at Port Arthur who committed murder in order to be sent to Hobart for trial. It is little to be wondered at that daring attempts at escape were made, despite the isolated position of Norfolk Island and the soldiers and ferocious dogs who guarded the narrow neck of land at Port Arthur. Attempts at mutiny were not uncommon; Norfolk Island, indeed, was on one occasion (in 1834) in the hands of the convicts, but in the end 9 were killed, 29 condemned to death, and 11 executed.

It is obvious that in the convict-system in operation until the end of the thirties, there was abundant room not only for displays of official vindictiveness but also for the practice of many forms of corruption. Apart from congenital tendency to cruelty, injustice, or dishonesty, the very association with so large a criminal element, and with barbarous methods, demoralized guards, gaolers, overseers, and police. It also demoralized many in higher places who were in a position to award favours and reap profits therefrom. A police which was partly composed of convicts had plentiful opportunities for obtaining bribes through connivance, for extorting blackmail, and for bringing false accusations. In assigning convicts among the competing settlers it was easy for officials to show favouritism. Wives or others who, themselves free settlers, had followed convicted husbands or relatives, and who were possessed of means, could indirectly purchase the assignment to themselves of those husbands or relatives, sometimes out of the produce of the very offence which had caused the conviction. Warders allowed convicts to quit barracks at night in return for a share in the booty which they might make by plunder.

As to the behaviour of convicts before and after emancipation, contemporary statements are contradictory, being coloured by different policies, interests, and sympathies. Phillip states that the convicts of the first fleet were 'quiet and contented, though there are among them some complete villains.' Many, undoubtedly, were hopeless criminals; nor must it be overlooked that, in many cases in which the specified charge brought before the British benches was trifling in itself, the magistrates must have been aware of much collateral delinquency. In both New South Wales and Tasmania wanton cruelties were perpetrated on the aborigines by convict shepherds. Convicts employed on the roads or in other non-domestic work often co-operated with convict servants in committing burglaries and thefts. From about 1827 men who had escaped from the road-gangs frequently indulged in highway robbery and

'bushranging.' Of emancipists or expirees the larger proportion, according to the Report of 1838, were profligates, dissipated, cattle-stealers, receivers of stolen goods, or otherwise worthless characters. Arthur described the 3000 of them in Tasmania as 'the worst class in the colony.' The effect on the community in general was of the worst, and of Sydney in 1836 it is stated that 'more immorality prevailed than in any other town of the same size in the British dominions.'

Nevertheless, considerable qualification must be made to these bald statements. Hunter's opinion has already been quoted. In 1827 Allan Cunningham wrote that the emancipists were 'the most useful and enterprising part of our community.' In 1820 Macquarie said that they 'have made wonderful efforts,' and he preferred them in 'both moral and political' character to the free settlers who 'struggle for their depression.' His successor, Brisbane, declares in 1823 that 'it is not the convicts who give me trouble, nor the emancipated convicts, who have uniformly behaved well, but it is your settlers and good people who call themselves gentlemen, who generally do all they can to thwart the Government.' The last words, it is true, betray the bias of a governor who resented the efforts of the free settlers to thwart his autocracy, and neither Macquarie nor Brisbane can be acquitted of prejudiced exaggeration. But the more temperate statement of Hunter cannot be thus set aside. Moreover the worst and most hideous evidence given before the committee of 1837-8 (which mainly determined the character of the Report) referred to conditions existing at Port Arthur and on Norfolk Island: and these, it must be remembered, were isolated settlements of supposedly hardened criminals, completely detached from ordinary life in the Australian colonies. The horrors depicted by Marcus Clarke in *For the Term of His Natural Life* are as little typical of Australian conditions—even of the conditions that affected convicts in general—as those catalogued by Charles Reade in *It Is Never Too Late to Mend* are of normal English society.

The strong and ever-growing opposition of the Australian colonies to the continuance of the convict system, and the recommendations of the committee of 1837-8, forced the British government to reconsider the whole subject of convict management. In 1839 it was decided to terminate as quickly as possible the system of assignment, and on 11 May Gipps was informed that convicts would in future be sent only to Tasmania and Norfolk Island. At the island the first experiment in reform was to be made under the direction of Alexander Maconochie (q.v.), whose schemes of reformatory—as opposed to vindictive and exemplary—punishment had much impressed the parliamentary committee. These schemes and the principles on which they were based are so important in the history of penal legislation that some space must be devoted to them here. In Maconochie's opinion, the method of remitting punishment was the most serious defect of the old system, as it gave much scope for favouritism and produced a feeling of uncertainty which militated against reform. The actual duration of sentences should be determined not by time but by good conduct, which should be definitely and regularly measured by a system of marks. Each prisoner should, unless misconduct were proved against him, automatically receive a fixed number of marks each day for his labour. These marks would be a form of wages, exchangeable for indulgences such as extra rations, or even redeemable in terms of money. Indeed, it would be preferable if no rations were issued at all by the government; the prisoners should be given marks enough to enable them (*a*) to purchase necessities and (*b*) to leave a balance that might accumulate for the purchase of freedom (for the remission of a sentence was to depend absolutely on the accumulation of a number of marks fixed according to the length of sentence). By thus exercising choice between an indulgent expenditure of marks in the present and a more rapid remission of sentence in the future, the prisoner would bear a continuous responsibility that would assist him to reform, for which there was no provision at all under the existing system. Maconochie admitted the need of a preliminary period of solitary confinement, but laid most emphasis on the subsequent period of mutual responsibility. Prisoners would be divided into small groups, the members to be responsible for each other's good behaviour. Military police and prison overseers were to be abolished. As the object of discipline was reform, and the chief means education, teachers must be appointed to train the prisoners in industries which they could subsequently pursue on readmission to society—hence the necessity of establishing a penitentiary on a site affording a variety of occupations. Throughout the period of imprisonment there should be a progressive relaxation of discipline, to encourage the prisoner to make a voluntary effort to resist temptation; and to this end Maconochie also opposed the complete separation of the sexes and of the young from the old.

The colonial office announced that for the future on Norfolk Island the actual length of sentence would be determined by a prisoner's good conduct. This did not commit anyone to approval of details of Maconochie's system; but it was suggested to Gipps that he might be a suitable superintendent of the island under the new conditions. Gipps agreed, and Maconochie accepted the appointment, though he considered Norfolk Island ill-suited to the experiment—owing partly to the lack of variety of occupation. A greater difficulty lay in the fact that the experiment was only to be tried with prisoners sent from England for the purpose, whereas there were already on the island about 1200 'twice-convicted' prisoners from New South Wales. This number, however, would gradually decrease as the colonial sentences terminated, for it was agreed that in the future colonially convicted men should not be sent to Norfolk Island. In the meantime, two systems of management would have to be operated, unless Gipps permitted Maconochie to bring them all within the scope of the new experiment. This Gipps refused to do; but he made the position easier by appointing an assistant superintendent to take over the more routine duties of the old establishment. Gipps also refused to allow the exchange of marks for indulgences until at least two years of the original sentence had been served, unless Maconochie found such exchange absolutely necessary to give his experiment a fair trial. Though Gipps had little faith in the success of the new system of management, he was prepared, since it had been sanctioned, to give Maconochie such assistance as he deemed practicable; he authorized, for instance, the expenditure of £50 on books and £143 15s. on music and musical instruments, as Maconochie attached great importance to the early formation of a library and to the cultivation of a taste for music among the prisoners. Maconochie

chie took office early in 1840; in March 1843 Gipps made an official visit to the island, and his report is a valuable commentary on this official experiment in penal reform.

Of Maconochie's success in managing the 'old hands' (of whom 876 were still on the island in 1843) Gipps wrote with almost unqualified approbation. Sympathetic control and the relaxation of discipline to permit the use of knives, walking through the island in leisure hours, bathing in the sea, a separate garden, etc., had had a markedly humanizing effect. The services in the Protestant and Roman Catholic chapels, for the building of which Maconochie had been reprimanded, had also contributed to this result. But the chief object of the visit was to enquire into the new experiment. Of the 679 'new hands' 75 had died of dysentery, aggravated by the deprivation of wheaten bread against which Maconochie had pleaded without avail. Of the remainder, 509 had won island tickets of leave in exchange for accumulated marks, varying from 6000 to 8000 according to the length of sentence. Each ticket-holder worked as formerly for the government, and received a daily ration and marks varying from 22 to 30 according to the nature of the work performed. The original scheme for the redemption of marks by money had not been put into effect, chiefly because of the opposition of Gipps, who feared an unlimited increase in expense. After the day's task-work was completed, ticket-of-leave holders were allowed to employ themselves to their own advantage. They lived out of barracks; some had been placed in small groups on farms of from 6 to 10 acres. For each acre cultivated they paid a rent of 12 bushels of maize, or one-third the average crop per acre raised on government land; uncleared land brought into cultivation was free of rent for the first year. Maize, sweet potatoes, potatoes, cabbages, tobacco, etc., were grown, and pigs and poultry had been procured from the superintendent in exchange for marks. In 1843 there were 27 such farms, worked by 78 persons, and Gipps admitted that this part of the experiment had been attended by considerable success. Many 'new hands' had acquired marks in excess of the number required for their freedom, but—owing to the difficulties of placing the men in Tasmania (it had been agreed that none of the 'new hands' should enter New South Wales)—their expectations had not so far been fulfilled. For this situation Gipps largely blamed Maconochie, first for not having adopted a preliminary punitory period, and secondly for having been so lavish in the distribution of marks as to allow their accumulation in excess of the number fixed for freedom before any preparation had been made for disposing of the men when free. Naturally interest in the acquisition of marks had fallen off, as was evidenced by an increase not so much in crimes of violence as in cases of gambling, unnatural offences, etc. Maconochie admitted failure in the case of the groups mutually responsible for the conduct of their members. The mark-system as a whole Gipps considered weak; to produce their full effect marks should be distributed daily, and should vary in number according to a man's conduct and work. Maconochie did not permit an overseer to deprive a man of his daily allowance of marks without bringing him to court; as a result, for months together the same men received the same number of marks though it seemed scarcely possible that they had behaved equally well throughout the period. Gipps also objected to the differential value given to various classes of work, which made it possible for a skilled artisan to secure his freedom earlier than an unskilled labourer. Gipps was convinced, too, that the productive labour of the 'new hands' was much less than that of the 'old.' The cost of each convict to the government had increased during the three years of Maconochie's control to £13 3s. 11d. per annum, whereas in the previous triennial period it had been £10 18s. 4d. This increase was exclusive of the increased cost of staff, etc. Though recognizing that the decision as to the continuance or abandonment of the experiment rested with the British government, Gipps admitted that he would be sorry to have the experience gained by Maconochie during his stay at the island wholly thrown away.

To keep faith with the 'new hands' who had accumulated the number of marks required for their freedom he was prepared to remove them to Tasmania on tickets of leave or conditional pardons in March 1843, although he believed that the change would not in general improve their economic condition; still, the 'new hands' were as eager as the 'old' to get away from the island, chiefly because of their enforced isolation from society. 'The yearning of their hearts' he wrote 'towards society is indescribable; it constitutes their torment; it is a punishment greater than the lash, or any other that man can inflict upon them.' Action was delayed, however, until the following spring, owing to the difficulty of finding employment for the men during the winter.

But the colonial office had already decided to relieve Maconochie of office, not because of any reflection on his character—indeed, Stanley ascribed to him 'a most earnest solicitude for the welfare of a class of society whose claims to compassion and benevolence have seldom been so keenly felt by persons in his station of life'—but because it had worked out a new scheme of convict management. From reports received in England it was generally believed there that 'what may have been gained by the relaxation of discipline in an increased mildness of demeanour has been more than compensated by the growth of moral and social evils of another kind.' Moreover, Maconochie's plans laboured under the serious disadvantage of 'impairing the dread of punishment of transportation' in Great Britain, and of involving the government (contrary to his own expectations) in an indefinite and increasing expense. The basic principle of the new system was that every convict must actually undergo punishment, without either pardon or mitigation, for some predetermined period proportioned to the length of his sentence. There were to be five successive stages of punishment, discipline being relaxed at each stage until the convict was competent to receive a pardon, either absolute or conditional; but he would never be entitled to demand it as of right. The first stage involved confinement in a penitentiary under severe discipline. Convicts sentenced for less than 15 years would serve this period of confinement in England; convicts with a longer sentence would be sent direct to Norfolk Island—which was to be detached from New South Wales and put under Tasmania in order to centralize control. Convicts already on the island were, as a preliminary measure, to be granted the satisfaction of any reasonable expectations they might have formed under Maconochie's supervision. The actual length of time to be served on the island

would be not less than two and not more than four years, and could not be abridged; good conduct during this period would be rewarded in subsequent stages of punishment. It was anticipated that not more than 1000 convicts would be sent to the island yearly. The second stage would involve work for not less than one nor more than two years (except in cases of misconduct) in one of the probation-gangs to be assembled in Tasmania; these would be subdivided into two or three groups to permit the grant of indulgences to the well-conducted, would consist of from 250 to 300 men, and would be employed at hard labour in government service—usually in the unsettled districts. Great importance was laid on the provision of religious and other instruction. It was anticipated that at any one time 8000 convicts would be employed in these gangs.

Having passed satisfactorily through the probation-gang, the convict would become the holder of a probation-pass, and might then engage in private service for wages approved by the government. Pass-holders would be classed according to conduct, the first class receiving only half their wages, the second class two-thirds, and the third class the total amount. The balance must be deposited by the employer in the savings-bank, to be paid to the convict when he obtained a ticket of leave; but, if a convict forfeited his probation-pass by misconduct, the deposit would become the property of the crown. Until private employment offered, pass-holders would work for the government, receiving rations and clothing but no wages. There was no limit to the period served as a pass-holder—except, of course, the length of sentence. The transition from this stage to that of a ticket-of-leave holder could not be made before half the original sentence had expired, exclusive of any extra period served in the first and second stages for misconduct. The status of a ticket-of-leave holder would be similar to that already obtaining. The final stage was that of a conditional or absolute pardon, which was exclusively the crown's prerogative.

The position of female convicts was admittedly different from that of males. Though the government recognized the evils arising from the disproportion of the sexes in Tasmania, they were not prepared to continue the transportation of women unless the 'additional incentives to vice' prevailing under the existing system were replaced by facilities for reformation. There was to be no further assignment of female convicts. The female factories at Hobart and Launceston—which were 'exceedingly discreditable . . . . subjecting every class of offenders to the contamination of mutual bad example, in rooms so crowded that according to very high authority it has occurred that the whole of the prisoners have been unable to lie down at one time and that a portion have been left standing while others rested'—were to be investigated with a view to increasing the accommodation, improving the classification, and effecting a more complete separation between the different classes of convicts. The women were to be encouraged to work for probation-passes, and ultimately for tickets of leave. New arrivals in the colony were not to be sent to the factories; for their reception the governor was to have constructed, at least 20 miles inland from Hobart, a penitentiary on the most approved plan capable of containing at least 40 persons. The 'new reformatory system,' which was to be introduced on the transports, was to be continued after arrival. After six months in the penitentiary women might receive probation-passes, providing they had not misconducted themselves in the meantime; pass-holders would be competent to advance through the subsequent stages of punishment on the same basis as males. It was hoped that respectable citizens would be prepared to hire servants from the penitentiary. If holders of probation-passes misconducted themselves, they would not be returned to the penitentiary but would be sent to a factory.

The whole penal establishment in Tasmania and Norfolk Island was to be put under the charge of a comptroller-general of convicts, sent from England and paid out of British funds, who would communicate with the governor direct and be practically a colonial secretary for this branch of the service. Before the proposed scheme could be put into operation, it was necessary to reserve to the Queen alone the prerogative of granting a pardon, the governor being empowered to grant remissions and mitigations of punishment; this was done by act of parliament (6 Vic. c.7).

By 1846 it was generally admitted that the new system had failed, not so much from any inherent weakness as from the impossibility of putting it into complete operation while four to five thousand convicts were being poured into Tasmania every year. On 1 January 1846 there were 29,949 convicts in the colony; of the 10,480 serving in probation-gangs, 3852 would receive probation-passes during the year and be competing for private service, although 3509 out of the 12,240 existing pass-holders were still unable to find work. On 30 September 1846 Earl Grey admitted that it had been found impossible to maintain proper discipline in the gangs because there were too few officers and overseers. Proper work could not be found for the gangs, nor could there be sufficient inducement to good conduct while so many pass-holders were perforce retained at government hiring-depots. Ticket-of-leave holders who were dependent on wages for subsistence had suffered great distress. To relieve the situation, it was decided to suspend the transportation of males to Tasmania for at least two years. Early in the year one of the most experienced officers responsible for convict discipline, John Stephen Hampton (q.v.), was sent to the colony as comptroller-general, and it was hoped that he would bring some order out of chaos.

Grey also proposed modifications in the existing system of management. He disagreed with Maconochie's contention that all punishment that was not reformatory was vindictive; on the contrary, 'the suffering imposed by society at large on some offending members in order to deter others from committing the same crime from a dread of subjecting themselves to the same condemnation, is the great and primary end of punishment.' Nevertheless, considerable advantages were to be derived from a more extensive and methodical application of the principle of task-work implied in the system of marks. He proposed, therefore, that the 'days' to be spent in the probation-gang should be measured by work. The task set for each day should be so fixed that a man of average power, by working hard, could complete one and a half or one and three-quarters days' work within the time, and might use this extra work to reduce the period to be served in the probation-gang, or exchange it at a fixed monetary rate for luxuries. This task-system, which was already in

operation in Bermuda, was in 1846 introduced in Tasmania, and continued until the break-up of the convict system with remarkably good results.

Meanwhile unsatisfactory reports of the conditions prevailing at Norfolk Island, where long-term prisoners were serving the first period of confinement, had reached both the governor of Tasmania and the colonial office. Investigation showed that the prisoners were on the verge of open mutiny, and Eardley-Wilmot at once suspended the superintendent, Major Childs, whose incapacity was chiefly responsible for the condition of affairs. Pending instructions from the colonial office, the police magistrate of Hobart was despatched to take over control; but before his arrival the threatened outbreak had occurred, with fatal results. The colonial office had already decided that the establishment at Norfolk Island should be immediately disbanded, but the governor on Hampton's advice recommended that it should be retained as a penitentiary for colonially convicted prisoners; for the practice of sending this class to the island, which had been suspended during Maconochie's term of office, had been resumed, and the impossibility of segregating the two classes of convicts had been partly responsible for the mutiny. This recommendation was accepted, and Norfolk Island ceased to be a place of first confinement for long-term prisoners. Indeed, the British experts on penology had come to the conclusion that no more convicts should be sent overseas until they were fit to receive tickets of leave on arrival in the colonies; but in 1852, before any large scheme on this basis could be developed, it was decided in deference to colonial opinion to terminate all transportation to eastern Australia. The convict system therefore died out as the sentences of men already in the colonies expired.

The system under which convicts were supplied to, and handled in, Western Australia is dealt with in the article on that State. T.G.T.

Convolvulaceae, a large family of herbs or shrubs, often twiners, widely dispersed, but most abundant in warm countries. The fruit is either capsular or succulent. Fourteen genera with 72 species are indigenous to Australia. The genus *Convolvulus* has 4 indigenous species, trailers or twiners. *C. soldanella* is a prostrate trailer on sandy sea-coasts in many parts of the world, and is regarded as a useful sand-binder. The genus *Evolvulus* is found mainly in tropical America; the only species indigenous to Australia, *E. alsinoides,* which ranges across the continent, extends also to tropical America and Asia. Its stalks, leaves and roots are reputed as remedial in cases of dysentery and fever. The genus *Cuscuta* (Dodder) has numerous species, chiefly in tropical regions; 3 are indigenous to Australia and one, *C. tasmanica,* is limited to Victoria and Tasmania. See IPOMAEA.

Cooee-bird. See CUCKOOS.

Cook, JAMES (1728-1779), was born at Marton-in-Cleveland (near Middlesborough in Yorkshire) on 27 October 1728. His father was then a farm-labourer, but soon after was made working bailiff to a farmer at Ayton. The boy worked on the farm, was for a short time stable-boy at Ayton Hall (see DUCKETT, SIR GEORGE), learnt a little at the village school, and at 17 was apprenticed to a grocer at Staithes near Whitby. The sea called him, however, and the agreement was soon cancelled in order to re-apprentice him in 1746 to John Walker of Walker Brothers, Whitby shipowners, under whom he served for nine years (three as apprentice) in vessels trading to Newcastle, Norway and the Baltic. During this apprenticeship Cook, as was the custom of the period, lived in his master's house when not at sea. The home life with John Walker seems to have had a large share in moulding his future, for the long evenings were spent in improving his book-knowledge, with the constant help of his master. It was then he acquired the grounding in navigation that was afterwards to stand him in such good stead; the North Sea and its seamen, then as now, provided a school of seamanship from whose rough but efficient teaching there was no escape. When the Seven Years' War broke out, Cook was mate of the *Friendship,* lying in the Thames; he volunteered for service, was promptly entered aboard H.M.S. *Eagle* as A.B., and 35 days later was rated master's mate. There was nothing unusual in this rapid promotion, for men combining first-class seamanship, fair education, a decent knowledge of navigation, and moderate sobriety of conduct were not plentiful. In the *Eagle* he served under Hugh Palliser, also a Yorkshireman, and saw fighting at the capture of a French East Indiaman; he was next transferred to the *Solebay* with a master's warrant and a recommendation from Palliser, and then to the *Pembroke,* in which he was present at the operations of 1759 on the St. Lawrence and the attack on Quebec. On 23 September 1759 he was transferred to the *Northumberland,* and while in her was particularly mentioned for 'indefatigable industry in making himself master of the pilotage of the River St. Lawrence.' In such leisure as he could command he was still working at his books, and during this period first studied Euclid. The *Northumberland* was afterwards present when St. John in Newfoundland was recaptured from the French; here also served another James Cook, first in the *Mercury* and then in the *Gosport,* with whom the circumnavigator has been frequently confounded. Cook's good work in these waters induced Admiral Lord Colville to commend him highly to the admiralty as a man of 'genius and capacity . . . well qualified for greater undertakings of the same kind'—i.e. survey work. Consequently in 1763 he was appointed to survey the coast of Newfoundland and the neighbouring islands—a task which lasted, with intervals for refitting in England, from May 1763 until November 1767. It was made at first in small vessels attached to the flagship, but in April 1764 Cook was given his first separate command in the schooner *Grenville,* with a crew of one mate, a servant and seven men. The charts he made, says the hydrographer Wharton, are not yet wholly superseded. While on the survey, he made on 5 August 1766 a good observation of an eclipse of the sun which brought him under the notice of astronomers and of the Royal Society.

In 1767 the Royal Society began to make preparations for observing in several parts of the world a transit of Venus across the sun's face that was due to occur in June 1769. For the South Seas Alexander Dalrymple was recommended; but he demanded full control of the ship set apart for the service, and Hawke (then first lord of the admiralty) refused point-blank to give the commmand of a king's ship to a man not a king's officer. At the suggestion of Palliser and of Stephens (one of the secretaries of the admiralty) Cook was chosen, and on 25 May 1768 commissioned lieutenant to

command H.M.S. *Endeavour*. For a description of this vessel and a discussion of her rig see COOK'S SHIPS, below. The scientific staff of the expedition included Joseph Banks (q.v.), Daniel Solander (q.v.), and Charles Green the astronomer. The *Endeavour* left England on 26 August 1768; the observations at Tahiti were successfully carried out, and the Society group cleared on 9 August 1769. Cook now laid a course southwards in order to strike, if it existed, the southern continent that Dalrymple and others postulated to balance the masses of land in the northern hemisphere. On 2 September, however, having reached 40° S. lat. without seeing a sign of land, and meeting with very tempestuous weather, he turned NW. and after a while made SW. again in order to fall in with the land discovered and laid down by Tasman as Statenlandt. This he sighted on 7 October, and in the evening of the 9th landed on the shores of Poverty Bay, where four Maoris had to be killed before he could establish amicable relations with the rest—'the most disagreeable day my life has yet seen,' noted Banks. After a detour southwards past 40° S. lat. to Cape Turnagain, Cook followed the coast-line north-about, rounded the Three Kings at Christmas time, put into Queen Charlotte Sound (16 January), passed the strait afterwards named for him (8 February), and worked northwards till he once more saw Cape Turnagain. Having thus proved that section of New Zealand an island, he turned on his tracks, coasted the southern island till he could round Stewart Island (12 March), ran back northwards to Cape Farewell (25 March), and on the 27th put into Admiralty Bay in Cook Strait to refit. This rapid survey was one of Cook's most remarkable achievements. 'Never' says Wharton, 'has a coast been as well laid down by a first explorer, and it must have required unceasing vigilance and continual observation in fair weather and foul, to arrive at such a satisfactory conclusion; and with such a dull sailer as the *Endeavour* was, the six and a half months occupied in the work (2400 miles of coast) must be counted as a short interval in which to do it.'

The dates given above for Cook's New Zealand voyage require explanation, since from 7 October onwards several of them differ by a day from those usually accepted. Cook, sailing westwards across the Pacific, passed in the morning of 6 October the 180th parallel of longitude, at which the day is technically supposed to begin—so that if in 179° W. you are in Monday 1 August, by passing to 179° E. you automatically enter Tuesday 2 August, although no night has intervened. The modern practice is to make this change of date immediately on crossing an arbitrary line in the Pacific, which for the most part coincides with the 180th meridian. In Cook's day, however, the practice was to wait until the vessel reached some port in the eastern longitudes that was already on the chart; and Cook made the required change when he reached Batavia on 10-11 October 1770. To bring, therefore, his New Zealand and Australian dates into correspondence with those now current, it has been necessary to advance by one day dates mentioned between 6 October 1769 and 9 October 1770. But this only applies to the dating of events that occurred before noon; for in ships' logs of those days the new day began at noon, and what we should call the afternoon of, say, 6 October was reckoned as part of 7 October.

After leaving New Zealand Cook decided to return, as his *Journal* tells us, 'by way of the E. Indies by the following route. Upon leaving this coast to steer to the westward until we fall in with the E. coast of New Holland, and then to follow the direction of that coast to the Northward or what other direction it might take us, until we arrive at its Northern extremity; and if it should be found impracticable then to Endeavour to fall in with the Land or Islands discovered by Quiros.' This part of his voyage is narrated under EXPLORATION BY SEA. When the *Endeavour* reached England in June 1771, Cook was highly commended by the admiralty and appointed to command the *Scorpion*—an appointment vacated shortly afterwards, so that he never actually took it up. On 14 August he was presented to King George III (to whom he gave a copy of his *Journal* and some charts) and was handed his commission as commander. Cook, Banks, and Solander at this time were 'lions' in London society, and may there have met Hawkesworth, the voluminous and conceited writer who afterwards sophisticated Cook's straightforward narrative, and for many years fathered on him his own absurd speculations and pompous dissertations. But Cook had little time for writing; almost at once plans were made for a second voyage of South Sea exploration—Dalrymple and others having alleged that there was still room in the unexplored South Pacific for a continent—and two sloops, the *Drake* and the *Raleigh*, were selected (probably by Cook himself) for the expedition, rechristened *Resolution* and *Adventure*, and on 28 November 1771 placed under Cook's command. He took the *Resolution* (Tobias Furneaux being given the *Adventure*), and in his own words 'every standing rule and order in the Navy was dispensed with' so as to fit out the vessels suitably and fully. Banks had intended to go on this voyage also, but, considering the *Resolution* unsuitable for so long a trip, abandoned the intention. The officers were not sorry; Banks and his retinue of scientific workers would have taken up 'the chief accommodations of the ship,' and would probably have insisted on making Australia, and explorations by land, the central task of the expedition; whereas Cook and his officers, naval men all, were mainly interested in the laying down of new coast-lines. In Banks's place Johann Reinhold Forster (q.v.) joined the expedition as naturalist and his son Georg (usually known as George) as natural history painter. The ships left Plymouth on 13 July 1772, visited Table Bay (30 October to 22 November), ran down to the southern ice-fields—crossing the Antarctic Circle on 17 January 1773—and E. towards New Zealand. Furneaux, who had parted from Cook on 8 February, put in at Adventure Bay in Tasmania, and, running up the east coast in bad weather, persuaded himself that the shore-line was continuous from Tasman's Pillar to Cape Howe. When on 18 May he rejoined Cook (who had gone straight to Dusky Bay and thence to Queen Charlotte Sound) and reported his views about the Tasmanian shore-line, Cook thought of revisiting Tasmania to check this opinion; but Furneaux was positive, and the course of events did not guide the *Resolution* that way. The rest of 1773 was spent in criss-crossing the southern Pacific until there was no unexplored space left for a continent. In November Cook was back in Queen Charlotte Sound, but Furneaux did not arrive; on the

25th, therefore, the *Resolution* sailed again for the south, and on 30 January 1774 Cook reached the point 71° 10′ S. lat., 106° 54′ W. long., in a region of the Antarctic where no later explorer has penetrated beyond him. He next went hunting for a patch of land in 38° S. said to have been seen by Juan Fernandez; that illusion being dispelled, he made by way of Easter Island and the Marquesas for Tahiti, thence round the Fiji group to the New Hebrides, and thence on 4 September discovered New Caledonia and on 10 October Norfolk Island. On 18 October he was back in Queen Charlotte Sound again, and left it on 11 November to cross the ocean towards Magellan Strait along the line of 54° S. lat. Cape Horn was rounded on 29 December, South Georgia sighted on 14 January 1775, and Table Bay revisited (22 March to 27 April); then Cook, having circumnavigated the globe in fairly high southern latitudes and so proved that no continent existed outside the Antarctic Circle, turned homewards and reached England on 29 July. There he found Furneaux, whose crew at the end of 1773 had come into conflict with the Maoris at Queen Charlotte Sound, and who had then made his way back to England round Cape Horn, reaching Spithead on 14 July 1774.

For some months Cook was fully occupied with the preparation of his journals for publication. This time Hawkesworth was not employed, being dead. It was at first proposed that Reinhold Forster should collaborate with Cook, the navigator writing up the events of the voyage, the naturalist contributing a volume of scientific results; but Forster became involved in a bitter dispute with Lord Sandwich, the first lord of the admiralty, and in the end Cook wrote the whole book and had it edited by Canon Douglas of Windsor. Many of Cook's letters to Douglas are preserved in the British Museum, and disclose the explorer's fine character. During his stay in London Cook met Boswell, who reported to Johnson that 'that celebrated circumnavigator' with conscientious accuracy had set right many of Hawkesworth's exaggerations. On 29 February 1776 Cook was elected a fellow of the Royal Society, and on 7 March read to the Society a paper on his methods of preventing and curing scurvy—which constitute by no means the least of his services to Britain. While in 1758 the *Pembroke* lost from scurvy 29 men out of 400 in crossing the Atlantic (and did better, at that, than any other ship of the fleet), Cook in two voyages, totalling five years and eleven months, did not lose one. On the preceding 9 August he had been given post rank and appointed to command at Greenwich Hospital, but never took up his duties there. The admiralty was already projecting another expedition to the Pacific, and the *Resolution* was being refitted for the purpose; the proposed commander was Charles Clerke, who had been Cook's second lieutenant in the previous voyage, and the object suggested was the discovery of a passage from the Pacific to the Atlantic northabout. Clerke's appointment was due to the feeling that Cook deserved a long rest. When, therefore, on 10 February 1776 he volunteered to take command, his offer was gladly accepted, and Clerke was given the *Discovery* in which to accompany him.

On 12 July 1776 Cook in the *Resolution* left Plymouth Sound, with orders to sail via the Cape to New Zealand and Tahiti, and thence to the 'New Albion' of Francis Drake in about 45° N. lat., and work up the North American coast in the hope of finding a passage round the continent eastwards or round Asia westwards. The *Discovery*, which did not leave Plymouth till 1 August, joined him at Table Bay. On his way eastward he visited the Marion and Crozet groups and Kerguelen Island, and on 26 January 1777 put into Adventure Bay in Tasmania. On 12 February he was in Queen Charlotte Sound; then, by way of the Cook and Friendly groups (at the latter he observed an eclipse of the sun), he voyaged to Tahiti (spending from 12 August to 7 December in the group), and north to Christmas Island (25 December). Towards the end of January 1778 he discovered the Hawaiian group, which he named after Lord Sandwich, and thence made north-eastwards to New Albion (7 March). The summer was spent in a vain attempt to find a passage to the Atlantic, at first round Alaska, then westwards along the Siberian coast. On 29 August Cook reached a point which he named Cape North—probably Cape Ryrkain south of Wrangel Island, but could get no farther on account of adverse winds.

In September he turned south to winter in the Hawaiian group. On 25 November he reached Maui, where the natives were more honest and less suspicious than any he had yet met; in January he moved on to Hawaii itself, and spent about a fortnight (17 January to 4 February) at Karakakoa Bay in amicable intercourse with the natives, who brought him great quantities of supplies. Always thoughtful of native interests, he felt that he had made inroads on their stores, and had better move elsewhere; but when he put to sea gales sprang up, the *Resolution's* foremast gave way, and he was forced back again. For a reason that has never been discovered—the Bay natives may have felt that they were being exploited, and that it was someone else's turn to provide Cook with food—on this second visit the behaviour of the natives altered completely. They resented the landing of watering-parties, stole articles from the ship and even the cutter from its moorings at the anchor buoy, and roughly handled several inoffensive sailors. On 14 February 1779 Cook landed with an armed guard to visit the king and take hostages for future good behaviour. While he was parleying, the surrounding crowd of natives learnt that elsewhere in the bay a chief had been shot by one of his crew; a warrior threatened him insolently and threw stones at him, while another tried to stab his lieutenant, and stones were thrown at the guard. Cook fired at his assailant, and the marines at their tormentors; there was a scuffle, and the English party was driven back to the beach. While giving orders to his boat's crew Cook made the fatal mistake of turning his back on the natives, and was at once struck down and killed. His body, with those of four slain marines, remained in possession of the natives. During the 15th it was ascertained that the body had been in part used for a feast of chiefs. The natives still remaining hostile and insolent, their village was fired on the 17th; and on the 20th and 21st what was left of the body (part of the skull and scalp, the hands and the bones of the limbs) was brought down with solemnity to the beach by a chief, handed over to Clerke (who was now in command) and at sunset buried at sea.

On 16 March Clerke left the group to continue

explorations in the Arctic seas. The summer was spent in further attempts to pierce the ice-pack beyond Bering Strait, and at the approach of winter Lieutenants Gore and King (Clerke having died on 22 August) brought the two ships down the Asiatic coast to Macao (1 December) and thence via the Cape to England, which was reached on 4 October 1780.

In March 1779, when Cook was expected back in home waters from his third voyage, Benjamin Franklin (then minister to France from the revolted American colonies of England) instructed the commanders of American warships to consider Captain Cook a friend if he should meet any of them, although technically he was an officer of the nation with which they were at war. This graceful act needs mention particularly because Andrew Kippis, Cook's biographer in 1788, asserted that congress reversed this instruction as soon as it was known in Philadelphia—and the assertion, which has no foundation at all, has occasionally been resuscitated in recent times. Kippis in 1795 withdrew the statement unreservedly.

As a circumnavigator Cook stands unequalled —first for the magnitude of the work done in the time, second, for its accuracy, third, for the preservation of the health of his people. The three great voyages were completed with less hardship and loss of life than had hitherto been thought possible. Cook's efficiency as a commander, and his scientific and seamanlike qualities, were not alone responsible for this; his personality had more to do with it than his efficiency. What manner of man he was is shown by the fact that, during the many weary months when the ships' companies were confined together in a small vessel, the entries of punishments in the log-books were fewer than could be found in any other ships in the service at that period. No quarrels of any kind are recorded, except that with the Forsters during the third voyage; and they disagreed with nearly everyone, and convict themselves by their own version of their grievances.

Dumont D'Urville said of Cook that he was the 'most illustrious navigator of both the past and future ages, whose name will for ever remain at the head of the list of sailors of all nations.' Another great French contemporary, in the last spoken words of his which history has recorded, paid a graceful tribute to the great Englishman: La Pérouse, as he was leaving Botany Bay, said to Lieutenant P. G. King 'In short, Mr. Cook has done so much that he has left me nothing to do but admire his work.'

Cook's services had been recognized by promotion to commander upon returning from the *Endeavour* voyage, and to post rank on his return from the second voyage. The King now granted a coat of arms to his family, and a pension of £300 per annum to his widow. The Royal Society, which had already given him the Copley medal for his wise precautions against scurvy, struck a special gold medal in his honour and presented it to Mrs. Cook.

Cook's family soon became extinct in the direct line. On 21 December 1762, just before he sailed for Newfoundland, he married a Miss Batts of Barking in Essex. By her he had six children: three died in infancy, the others before the end of the century. James, the eldest, rose to command H.M. sloop *Spitfire*, and was drowned off the Isle of Wight in 1794. Nathaniel, the second, was in 1780, at the age of 16, lost in H.M.S. *Thunderer*, which foundered at sea. Hugh, the youngest of all, died in 1793, when only 17, at Cambridge, where he was studying for the church. Mrs. Cook, to whom (as well as to the three boys) George III had granted a pension, lived to be 93, and died at Clapham on 13 May 1835.

The value of Cook's discoveries along the Australian coast is recognized in several memorials. In Hyde Park, Sydney, there is a statue of him by Thomas Woolner, R.A., which was unveiled on 25 February 1879; and the landing-place at Kurnell on Botany Bay is marked by a tablet and a monument, near which the event is annually commemorated. Tablets are also placed on Cape Everard, near the hill first sighted from the *Endeavour;* on Mount Warning, the 'remarkable high peak' noted in Cook's log on 16 May 1770; and on Possession Island in Torres Straits, where he formally annexed the eastern coast to Britain.

For Cook's early life the best authority is Dr. George Young's *Life of Captain Cook,* published in 1836. Young was vicar of Whitby early in the 19th century. The various Cook logs, to be found in handy form in the *Historical Records of New South Wales,* are better material for a student than any books made from them. The *Life* by Kippis is often inaccurate. A *Life* by Arthur Kitson, published in 1911, is considered the best by many Cook students. For the first voyage (1768-1771) the final authority must be Cook's own autograph journal. Until 1921 it was supposed that this journal had perished, but three copies were known, one of which (the 'Corner' journal) is in the Australian Museum at Sydney. But in 1921 the original MS. was found among some Cook documents owned by H. W. F. Bolckow of Marton-in-Cleveland, having been apparently bought by his grandfather about 1835 from the executors of Captain Cook's widow. In March 1923 the journal and other documents were purchased at public auction by the Commonwealth and are now (1925) in the Mitchell Library at Sydney. The journal is being meticulously examined for any possible divergences from the previously known copies.

Cook's Ships. The first vessel in which Cook went to sea was the *Freelove,* a full-rigged ship of 341 tons, built at Great Yarmouth in 1746, owned by John Walker of Whitby and commanded by John Jefferson. He was on the books from 5 February 1747 till November 1748, when he joined the *Three Brothers* (same owner and master). In 1750 he was on the books of the *Mary* owned by John Wilkinson; in 1753 he was appointed mate of the *Friendship,* where he remained until he joined the navy. The *Freelove* was lost a few years after Cook left her, the *Three Brothers* in 1753, the *Mary* in 1762 and the *Friendship* in 1769. There is no truth in the often printed statement that the *Three Brothers* was afloat until late in the 19th century; the name was given to many Whitby ships. Cook's service in the Royal Navy was in the *Eagle* (June 1755 to June 1757), *Solebay* (July 1757 to September 1757), *Pembroke* (October 1757 to September 1759), and *Northumberland* (September 1759 to October 1763). He was then borne on the books of the *Antelope* and the *Tweed* while serving in small vessels on the survey of the Newfoundland coast. His first separate command as master was the *Grenville.*

The *Endeavour Bark,* as she was officially

named by the admiralty, was built at Whitby in 1764 by Thomas Fishburn for Thomas Milner, from whom the government purchased her. She was named by Milner the *Earl of Pembroke*, and was of 270 tons, square-rigged with an uncoppered bottom, of a build peculiarly adapted to taking the ground with safety—which was one of the reasons for Cook's selection of her. She is often described and pictured as barque-rigged; but Cook's log, and the custom-house entry at Whitby, prove that she was a ship. Many stories have been told of her ending, but all lack proof. When Cook was preparing for his second South Sea voyage, the *Endeavour* was on her way to the Falkland Islands as a store-ship; this is her last recorded service, and the admiralty sold her in 1775. A generally accepted version is that she ended her days on the beach at Newport in Rhode Island, U.S.A. The author of this story gives chapter and verse to show that a vessel named *Endeavour* was purchased from the British government in 1796. But Cook's *Endeavour* was sold 21 years earlier; moreover, there were 11 *Endeavours* on the Whitby register between 1749 and 1795, and more than one was sold during the same period.

The *Resolution* and the *Adventure* were built in 1770 by Fishburn of Whitby, and owned by William Hammond of Hull. Nothing certain is known of the fate of the *Resolution*; but John Barrow, while on his way to China in the Macartney expedition, saw a hulk at Rio de Janeiro which, he asserts, was this ship. Too many *Resolutions* were registered at Whitby to allow unqualified acceptance of this statement. The *Adventure* is known to have been lost in the Gulf of St. Lawrence in 1811. The *Discovery* was built at Whitby in 1774 by Langhorne for Herbert of Scarborough; nothing is known of her history, but E. W. Cooke, R.A., sketched a convict-hulk on the mud at Woolwich, and called his sketch 'The *Discovery*.'

An excellent authority for the Whitby ships in which Cook served is *The Ancient Port of Whitby and its Shipping*, by Richard Weatherill, published at Whitby in 1908. W.J.

For the build of the *Endeavour* two pictures have hitherto been usually accepted as evidence—the picture at Kurnell, taken from Weatherill's *Ancient Port of Whitby*, showing the *Earl of Pembroke* in 1768, and the alleged pencil sketch, by Buchan, of the *Endeavour's* hull, which is reproduced in vol. i of the *Historical Records of New South Wales*. The Kurnell picture has neither technical nor artistic merit, and in no way corresponds to the admiralty plan of the *Endeavour* that hangs alongside it.

The *Endeavour*

The Buchan sketch—if it is by Buchan at all, which is very doubtful—cannot be of the *Endeavour*: it represents an old vessel, probably a two-masted brig, of a build common 30 years before Cook sailed, and the only particular in which it corresponds to the authentic plans of Cook's ship (one at Kurnell, and two in the Pioneers' Club at Sydney) is the shape of the upper half of the stern—a shape common in North-country-built vessels designed for the Baltic timber trade. When Buchan died, in April 1769, the *Endeavour* was not yet five years old.

It has often been stated that Cook's ship was named the *Endeavour Bark* to distinguish her from another *Endeavour* that was already in the navy. The explanation is not convincing, since Admiral Wharton says that this other

Endeavour was a cutter; Laird Clowes, however, says that she carried 14 guns, and was lost in the West Indies in 1780. However this may be, Cook's ship was probably rated as a bark on account of her cat build (with straight stem and no figure-head), in which she differed greatly from the ordinary naval vessels of the day. F.J.B.

Cook, Sir Joseph, born at Silverdale in Staffordshire in 1860, began life in a coal-mine at the age of nine. Migrating to Australia in 1885, he worked in the mines at Lithgow until 1891, when he was sent to parliament from the Hartley electorate as one of the labour party, then making its first appearance in the legislature. In 1893 the party, declaring itself neutral as a whole on the fiscal question, split up when matters connected with the tariff were under discussion, and Cook was chosen leader of the freetrade section. In March 1894 the party conference confirmed a proposal that every labour candidate should bind himself not only to support the party platform, but to vote on all questions involving the fate of a ministry as the majority of the parliamentary caucus might decide. Cook, refusing to take such a pledge, left the party, and on 3 August was taken into Reid's ministry as postmaster-general. In 1898 he was made minister for mines, and held that post until Reid was thrown out of office in 1899. He held the seat for Hartley as long as he remained in New South Wales politics, and built up a reputation as an honest administrator, not specially effective in debate but always to be depended on in emergencies. In March 1901 he entered the Federal parliament as member for Parramatta, which constituency he continued to represent for 20 years. In the first parliament he was merely one of the rank and file of the freetrade opposition, but established a reputation for 'fighting' speeches. When Reid late in 1905 gave up all hope of effecting a coalition, he determined to make his opposition an active and felt influence, and substituted Cook for Dugald Thomson as deputy-leader. From that time Cook was the real head of a critical and persistently fighting opposition. When Reid resigned in 1908, Cook's services to his party outweighed the prestige of John Forrest; he was elected leader, and joined Alfred Deakin in the coalition ministry of 1909-10, taking the portfolio of defence and helping his senior colleague to obtain the establishment of an Australian naval 'unit' (see Naval Defence) and to procure the services of Lord Kitchener as adviser in the construction of a compulsory training scheme (see Military Defence). When the coalition was driven from office in 1910, Cook gradually replaced Deakin in all active debate, and, succeeding him as leader in 1913, became prime minister in that year. Again in opposition from 1914 to 1917 (but giving the then ministry full support on all war measures), he in 1917 joined a coalition ministry as minister for the navy, was one of the Australian representatives at the Versailles peace conference, returned to become treasurer of the Commonwealth, and in 1921 left politics to take the position of high commissioner in London. (P.C., 1914; G.C.M.G., 1918.)

Coolabah (also Coolibah, Koolibah and Coolybar), aboriginal name of *Eucalyptus microtheca,* common in the interior of Australia from the north-west to the Murray and the Cloncurry. It grows along water-courses, and in the region neighbouring the Gulf of Carpentaria is known as 'flooded box.' On the arid inland plains its presence is a sign of water, if not on the surface, at least not far below it, and it is often used by travellers as a shelter for camping. It was on a coolabah that Brahe carved the word 'Dig' to indicate to Burke and Wills (see Exploration by Land) where he had buried their stores.

The name is also loosely used for other eucalypts (*E. conica* and *E. intertexta*), and sometimes for a relative of the eucalypts, *Angophora melanoxylon.*

Cooper, Sir Charles (1795-1887), born in March 1795 at Henley-on-Thames, and entered as a student at the Inner Temple in January 1822, was called to the bar on 9 February 1827, and practised on the Oxford circuit. In 1838 he was appointed a puisne judge of the supreme court of South Australia, in succession to Sir John Jeffcott; he reached Adelaide in March 1839, and for 10 years was the only judge in the colony, conducting unaided three courts—civil, criminal and insolvency. On 26 March 1849 he was appointed the first chief justice of the colony. Apart from his judicial work he occasionally acted as draftsman of important statutes, among them the first South Australian insolvency act. He was an intimate friend of Charles Sturt, who named Cooper's Creek after him, and protested vehemently when in 1859 the Sydney survey office proposed to alter the name to 'Kennedy River.' Owing to ill-health he retired on 26 November 1861 and returned to England; he died at Bath on 24 May 1887. (Kt. Bach., 1857.)

Cooper, Sir Daniel (1821-1902), born at Bolton-le-Moors in Lancashire on 1 July 1821 and educated at University College, London, received his early mercantile training with a firm trading at Havre in France and in 1843 returned to Sydney (where he had lived with his parents for some years in childhood) to join his father's firm of Holt and Cooper, which in 1851 became Cooper & Co. In 1849 he was elected to the old New South Wales legislative council by the counties of St. Vincent and Auckland, but retired at the dissolution of 1851, visited England on several occasions in the next few years, and gained prominence as the originator of an Australian fund to relieve distress caused by the Crimean war. In March 1856 he was elected to the new legislative assembly by Sydney Hamlets, held the seat till April 1859, and then transferred to Paddington; he was speaker of the house in the three parliaments during which he served, but on 31 January 1860 resigned the position on account of failing health, and retired from politics at the end of the year. From that time till his death on 5 June 1902 he resided in London.

Cooper's wealth, acquired partly from commerce and partly from investments in land, was largely spent on philanthropic objects in England and Australia. For the university of Sydney (of which he was a senator from 1857 to 1861) he created a fund from which one graduate and three undergraduate scholarships are now provided; but his chief benefactions were connected with the distress caused in Lancashire by the American civil war, and for his gifts and services in that crisis he received a baronetcy. On several occasions in his later years (e.g. in 1888 and from 1897-9) he acted as agent-general for New South Wales. (Kt. Bach., 1857; Bart., 1863; K.C.M.G., 1880; G.C.M.G., 1888.)

Coots. See Rails.

Copper. Ores of this metal are said to have been found near Macquarie Harbour in Tasmania on 20 April 1827, and somewhere in New South Wales during January 1829; but these discoveries were not followed up, and may, indeed, have been mere rumours. The first certain discovery of copper in Australia was made by Francis Dutton and Edward Bagot at Kapunda, 50 miles north of Adelaide, in 1842; samples of the ore were sent to England, and on the receipt of a favourable report a mine was opened and miners were engaged both on wages and on tribute. In 1845 a shepherd named Pickett found outcrops at Burra Burra, about 100 miles north of Adelaide; on the biggest of these was established the famous Burra Burra mine, which in 30 years produced almost five million pounds' worth of copper, and paid £800,000 in dividends on a nominal capital of £12,320, none of which was ever called up. In New South Wales the metal was mined for in 1844, and in 1845 deposits at Molong and Canowindra were exploited; during the next 20 years a large number of mines were worked at various places in the western foothills of the main range, chiefly in the neighbourhood of Orange. In Western Australia the excitement caused by the South Australian discoveries caused a good deal of searching, but the first actual finds were made on 18 December 1846 in the area south-east of Perth, and the first serious attempt to mine for copper followed on Augustus Gregory's discovery of the ore at Northampton (near Champion Bay) in 1848. Owing, however, to lack of labour and remoteness from Perth, mining was carried on in a very perfunctory fashion, and work was discontinued as soon as the lodes began to contract. In 1860 mines were opened at Wallaroo and Moonta in South Australia, and in 1862 at Peak Downs and Mount Perry in Queensland; in Victoria also several small deposits were located, but the only one of any size was at Walhalla in Gippsland. In Tasmania no discoveries of commercial value were made until 1890, when the Mount Lyell goldfield, north of Macquarie Harbour, was found to contain plentiful supplies of native copper.

The principal fields in Australia where copper is being, or has of late years been, mined are situated near Cloncurry and Mount Morgan in Queensland, Cobar in New South Wales, Wallaroo and Moonta in South Australia, West Pilbara in Western Australia, and Mount Lyell in Tasmania. At Cloncurry ore was discovered in the late sixties; for a few months in 1886 attempts were made to smelt the ores locally, but with that exception they were shipped south until 1909, when the Mount Elliot Company opened reduction works at Selwyn; similar works were opened at Kuridala in 1911 and at Mount Cuthbert in 1917. At Mount Morgan, which was worked for many years solely as a gold-mine, copper-smelting began in 1906, the blister copper being sent to Port Kembla in New South Wales for final treatment. The collapse in copper prices after 1918, followed by repeated strikes, resulted in the closing down of this mine in 1921-2, and a second closing-down is (1925) imminent. At Cobar, where copper was discovered in 1869, the richer surface ores were at first sent by team to Bourke and shipped down the Darling to smelting works at Port Adelaide. From 1889 to 1893 operations were suspended, but in the latter year the chief mine was reopened on tribute and blast furnaces erected; as a railway to the area had been opened in 1891, success was immediate and prolonged. In 1920, however, most of the mines were sealed down and the plants dismantled. At Wallaroo and Moonta operations have been more continuous than anywhere else in Australia; the Moonta Company was the first in Australia whose dividends accumulated to a million pounds, and in 63 years the two mines have produced nearly £20,365,000 of copper and paid over £2,600,000 in dividends. The reduction works are at Wallaroo, the mines now worked being at Kadina and Moonta. In Western Australia the original Northampton field gradually became a source of lead rather than of copper, and the principal copper-field of late years has been on the West Pilbara goldfield, S. of Roebourne, the next in importance being the Phillips field on the Bight, W. of Esperance. The Mount Lyell field in Tasmania, whose copper resources began to be developed in 1893, was in 1901 producing nearly half the copper in the Commonwealth, but after 1906 came second to the great Queensland mines. The following figures will show the relative importance of the various fields, and the disastrous effects of the post-war collapse in prices:—

	1917 TONS	1919 TONS	1922 TONS
Queensland (chiefly Cloncurry and Mount Morgan	19,062	9997	5104
New South Wales (chiefly Cobar)	6576	1460	625
South Australia (chiefly Wallaroo and Moonta)	7213	2517	1185
Western Australia (chiefly West Pilbara)	1501	459	1012
Tasmania (chiefly Mount Lyell)	6616	5071	5616

The value of the Commonwealth copper production for these years was nearly five millions sterling in 1917, under two millions in 1919, and not quite £850,000 in 1922.

Methods of Production. Copper produced in Australia can be broadly classified as derived from the following sources:—(*a*) mines (or group of mines) in which the ore supply is sufficiently large to maintain its own smelting plant; (*b*) mines in which the ore supply is not sufficiently large to comply with (*a*), but which maintain a concentrating plant and forward the concentrates to customs smelters for treatment; (*c*) small mines operated and owned by private individuals, the ore mined from which is generally hand-picked and sold to customs smelters. The ore produced from this class of mine is, in the main, oxidized ore.

Metallurgically considered the ores of copper can be classified under two main groups, (1) oxidized and (2) sulphide ores; in the latter the gangue may be (*a*) basic, (*b*) siliceous. Generally speaking the ores of group 1 are not smelted direct, owing to the excessive cost of the coke required in the smelting. They are in general smelted along with the ores of group 2 *a*. Ores of group 2 *a* are smelted direct. Those of group 2 *b* are in general concentrated by crushing and separation of the gangue from the metallic particles by treatment in jigs, concentrating tables, etc., followed by flotation. This treatment gives (*a*) concentrated metallic values, and (*b*) worthless tailings comprising the major portion of the siliceous gangue of the original ore.

The economic point at which an ore should be concentrated is largely dependent on the cost and supply of basic fluxes. Silica alone, at ordinary smelting temperatures, may be regarded as infusible; with a correct proportion

of limestone and ironstone it forms a mixture readily fusible within the range of smelting temperatures. Concentrates are delivered from the mill in a form not suitable for the blast furnace. The Australian practice is to sinter the concentrates in Huntington-Heberlein pots or on Dwight-Lloyd sintering machines. The object is two-fold, to agglomerate the fine concentrates, making them suitable for treatment in a blast furnace, and to eliminate the excess sulphur. When once the ores of group 2 *b* have been concentrated, and the resulting concentrates sintered, they are as amenable to treatment in the blast furnace as the other groups. In the blast furnace the ore, fluxes and fuel are in intimate contact, and combustion is intensified by the use of a forced blast of air. Its products are a small, rich, metallic portion (matte), and a large worthless portion (slag). In Australian practice the average grade of matte carries about 40 per cent of copper, as well as any gold or silver that is in the ore.

The next process is to free the copper from the iron and sulphur. This is accomplished by placing the molten matte in a vessel so constructed as to allow a blast of air being passed through the molten charge; silica (in the form of siliceous ores) is added, and the iron, oxidized to ferrous oxide, combines with the silica, forming a slag which is poured from the charge. The sulphur passes off as sulphur dioxide. When this process is complete only copper and precious metals (if any) remain; this is known as blister copper, and is about 99 per cent pure. If it contains gold or silver values, it is then electrolytically refined. It is moulded into special sheets (anodes), which are suspended in an electrolytic cell alternately with sheets of pure copper (cathodes). The electrolyte is an acidulated solution of copper sulphate. On passing a current through the cell the copper of the anode is deposited on the thin sheet of cathode copper; gold and silver fall as a sludge to the bottom of the cell, and are separately refined. The cathodes are remelted, and cast into ingots suitable for commercial use. O.H.W.

Coppin, GEORGE SELTH (1819-1906), born at Steyning in Sussex on 8 April 1819, was the son of a physician who took to theatrical management. The boy began as an infant prodigy, playing the violin in public when only four years old and acting a few years later. By 1841 he had stage-managed at Woolwich, played minor Shakespearian parts at Sheffield, and starred in low comedy vaudeville at Manchester and Dublin. Eloping with an American actress, he reached Sydney on 10 March 1843, secured an engagement at the Victoria Theatre, and lost all his savings by an unlucky speculation in hotel-keeping. In 1845 he 'starred' in Hobart and Launceston (January-May), and in Melbourne from June onwards; in 1846 he moved to Adelaide, made a second fortune there, and lost it all in copper-mining speculations. In 1851 he tried gold-digging for a fortnight, and then made a third fortune on the stage in Melbourne and Geelong. A short visit to England in 1854, during which he appeared at the Haymarket in London and at the bigger provincial theatres, resulted in the engagement of G. V. Brooke for a tour through Australia. Returning to Melbourne, Coppin for another 10 years resumed his habit of making money in the theatre and losing it outside. In 1855 he opened in Melbourne the new Olympic Theatre, often known as the 'Iron Pot'—a galvanized iron structure which had been made for him in Birmingham. In 1856 he joined Brooke (whose tour had proved very successful) in purchasing the Theatre Royal at Melbourne, which he used for the first grand opera season ever given in Australia. In 1863 he brought the Keans to Australia, paid all his debts with the profits of their tour, then accompanied them to America, but was back in Melbourne by the beginning of 1866. In 1881 he retired from the stage, having built six theatres in Australia during his career and introduced more than 200 artists.

Side by side with theatrical work he found time for politics. In 1858 he was elected to the Victorian council from the south-western province, and was an ardent advocate of federation and intercolonial freetrade. Resigning when he went to America in 1864, he was sent 10 years later by East Melbourne to the assembly, and held the seat until 1889, after which the Melbourne province elected him unopposed to the council. Never a partisan, he was very popular in both houses, but was not taken seriously as a politician. In other ways, however, he did good public service. He was one of the founders of Sorrento near Port Phillip heads, of the Victorian Humane Society, and of the Old Colonists' Association; he persistently advocated acclimatization, and himself introduced English thrushes. He died at Melbourne on 12 March 1906.

Coprosma, a genus of the family Rubiaceae, consisting of erect, prostrate, or creeping shrubs. The calyx is toothed or lobed; corolla-tube short with 4 or 5 (rarely 6) lobes; fruit a berry-like drupe, with 2 stony seeds furrowed on the inner face; flower usually insignificant, in clusters, often with a fetid odour. The sexes occur on different plants. *C. hirtella* has a small edible fruit with a disagreeable flavour. *C. Billardieri* has a small round drupe, which the early Tasmanian settlers made into puddings. Both are ornamental shrubs.

Copyright in Australia is governed by the Imperial act of 1911, of which a detailed account is given in *Chambers's Encyclopaedia,* vol. iii. But this act and the orders in council which regulate foreign copyright within the Empire were primarily devised to meet British needs and conditions, and conditions in Australia are in some respects so different as to impose on publication within the Commonwealth hardships worth discussion.

The provisions of the act of 1911 with regard to the meaning, duration and ownership of copyright, so far as British subjects are concerned, involve no hardships, and probably for this reason it was adopted as a whole by the Commonwealth parliament in 1912. Nor are there any Australian objections to the extension of British (and therefore of Australian) copyright to other members of the Berne Copyright Union, since the basis of that Union is that each member puts authors belonging to other members on the same footing as its own authors. But with regard to the United States, which stands outside the Berne Union, the position is different. An American author or publisher secures copyright throughout the British Empire (and therefore, of course, in Australia) by 'publication'—that is, by registering his book and offering it for sale—anywhere in the Empire or in any country that adheres to the Berne Union. But an Australian author or publisher can secure copyright in the United States only by conforming with the American law which requires that all books in

the English language must be set up, printed and bound within the States, within sixty days (the period of grace may be at most extended to six months) of its original publication elsewhere. This means that, whereas the American author secures Australian copyright by a mere formality gone through in London or any other part of the Empire, the Australian author must go to the great expense of producing a separate edition of his work in the United States.

This law was brought into being under pressure from labour unions in the States in order to ensure local production. The view of high authorities in America may be gathered from the 1919 *Report of the Register of Copyrights* at Washington:—

> The remedy indicated to benefit both American and British authors is such action as will confer copyright security in all the English-speaking countries from the day the work is first published in any one of them. The statutory requirements of publication and manufacture should be subordinated to this secured protection of the author's literary and artistic property.

With such an official acknowledgment of the existing injustice it should not be difficult to find a remedy in exact reciprocity—imposing on authors of non-British nationality the same conditions of copyright as their nation imposes on Australian authors. The parliament of the Commonwealth can do this by substituting for the adopting act of 1912 a new act substantially identical with the Imperial act, but applying to American authors the conditions of the American law.

Coral, the name given to members of the Coelenterata that protect themselves with a limy skeleton. A few Hydrozoa have this habit; all true corals, however, belong to the class Actinozoa, and are merely sea-anemones that have acquired the habit of secreting (*a*) a limy outer wall, and (*b*) a series of internal radiating limy plates. They are known as madrepore corals. When formed by a solitary polyp, the resulting cup-coral is known as a corallite; in the majority of species a large number—sometimes many thousands—of corallites combine to form a corallium, the skeleton of the entire coral-colony.

Some coral-animals, like the majority of sea-anemones, are solitary; the well-known Mushroom-coral (*Fungia*) is an example. It takes its name from its resemblance to the head of an expanded mushroom turned upside down. Solitary corals are found in pools of the reefs surrounding many Pacific islands, and also on the Great Barrier Reef. When the polyp is expanded, it might easily be mistaken for a big sea-anemone; on being disturbed, however, it immediately shrinks back upon its base, ejecting all the water with which its tissues were filled, and revealing the presence of the hard, radiating coral beneath. New mushroom corals are produced as buds thrown off from the parent. These buds attach themselves, and secrete a foot-stalk to which they remain affixed for the earlier stages of their existence. Ultimately they fall from their stalks, and lie loosely on the sea-bottom after the manner of their parents. A common solitary form is the fan-shaped Crisp-coral (*Flabellum*), which has been found to occur even in the cold waters off southern Tasmania; another is the little conical *Conocyathus*, frequently found at Watson's Bay in Port Jackson.

The great majority of coral-polyps form aggregates or colony-stocks of numerous units, brought about by repeated budding, or by the subdivision without complete separation of a single individual. The huge coral-masses commonly known as madrepores, out of which coral islands and reefs are constructed, all commence as a single coral-animal, with its contained skeleton similar to that of a mushroom-coral, although in every instance much smaller. The buds in these instances remain attached to the parent. If they spread out laterally, they build up by accumulation the large, flattened, subspherical or globose masses known as star-corals (*Goniastraea* and *Favia*), and brain-corals (*Meandrina* and *Coeloria*), the surfaces of which look like a series of deeply excavated valleys. Where, on the other hand, the budding is terminal or oblique, branching tree-like growths—such as the stag-horn corals, with their innumerable allies and variations—are produced. Isolated patches of coral (*Plesiastraea*) occur in parts of Sydney Harbour, where they appear like green moss when seen alive on the overhanging edges of rock-pools. Three species of *Plesiastraea* apparently occur in the extra-tropical seas of Australia. Their occurrence in South Australian waters must be regarded as a remarkable instance of a characteristically tropical type living in low-temperature seas. They are coral-reef forms, and members of a family which are essentially coral-reef builders; but even on the reefs, apparently, they do not grow to any large size—which makes their occurrence in huge proportions in extra-tropical waters all the more remarkable.

Coral-reefs and Coral-islands.—Coral-polyps play an important part in the economy of nature. Reef-building corals are confined to the tropical parts of the Atlantic, Indian and Pacific Oceans, flourishing only where the lowest temperature does not sink below 68° F. Thus their northernmost limits are the Bermudas in the Atlantic, and southern Japan in the Pacific; their southernmost limits Rio and St. Helena in the Atlantic, Queensland and Easter Island in the Pacific; in other words, they extend to about 30° on each side of the equator. Moreover, they have a curiously limited vertical distribution, flourishing only from high-water mark down to a depth of about 20 fathoms, but not lower. In the Pacific Ocean the southern limit should be extended to include Lord Howe Island (q.v.), the most southern of the outlying islands on the east coast of Australia; its western shore is protected by coral growths forming a fringing reef. When reef-building corals first take possession of a new shore, they grow upwards from the shallow bottom and outwards into the surf. During severe storms they are wrenched from the bottom and rolled about by the action of the waves, the larger fragments of their limy skeleton being finally thrown back towards the land, forming shoals, and sometimes rising in a beach a little above sea-level; the finer particles are carried off shore and strewn over the sloping bottom towards deep water. The reef thus broadens, forming a fringe close along the shore-line. At this stage it is called a fringing reef. A fringing reef is broadened by the outward growth of the corals, and the submarine slope is built forwards by the supply of coral fragments; at the same time water supplied by rain, by streams from the land, and especially by surf rolling over the reef, slowly dissolves and washes away the inner part of the reef, where living corals are few or wanting. Thus the reef may come to be separated from the land by a shallow lagoon, and in this manner a fringing reef may change to a barrier reef.

At first sight a coral reef is very disappointing; the surface, composed of dead and broken coral, presents a long vista of heaps of discoloured fragments that have been piled up by the action of the waves. As the coral grows nearer to the surface of the sea, portions become exposed to the direct heat of the sun when the reef is uncovered at low tide, and under these circumstances the coral soon dies. The branched forms (stag-horn coral) die first, and their broken, limy skeletons compose the main bulk of the reef. In the deeper pools left by the receding tide, and on the outer edge of the reef, flourish the living corals, which are of extreme beauty and of the utmost interest. As these continue to grow all round the edges in the deeper water, they are continually enlarging the size of the reef. There are many different kinds, from the branching stag-horn coral to the great rounded masses of the brain-corals, which may be three feet or more in diameter. The colours of living corals are brilliant and diverse, one branching variety being a beautiful light green, with the end of each branch terminating in a bright yellow tip. Some show various shades of pink, others a brilliant blue.

If a reef is depressed faster than the corals can grow upwards, the depth of water above it will increase beyond that in which reef-building corals can live. Then the polyps are 'drowned' and the reef is 'dead.' When, however, a slow depression takes place, it may be counteracted by the upward growth of the reef-corals; the reef will be preserved, and may even increase in size by outward growth during depression. At the same time the lower slopes of the island which the reef first fringed will be submerged; as the slow depression continues, the central island may finally disappear, leaving only an encircling reef of oval or irregular outline around the lagoon. Such reefs are called atolls or coral-islands.

Our knowledge of the formation of coral-reefs and coral-islands is based mainly on the work of Darwin, who conceived and expounded the subsidence theory, and on the subsequent researches carried out by Edgeworth David (q.v.) on the island of Funafuti in the Ellice group, where a successful boring was made to a depth of 1114 feet. The material from the bore was found to be coral-formed limestone, thus proving the justice of Darwin's assumption as to the nature of the substratum, and giving support to the subsidence theory as applied to this particular island. Supplementary work has been carried out by Charles Hedley, Griffith Taylor, and E. C. Andrews on the Great Barrier Reef of Australia, and by Mayer on the reefs of Murray Island in Torres Straits. In recent years the opinion has been expressed by several authors that the subsidence theory cannot account for the formation of all the atolls and barrier reefs that have now been investigated, and alternate hypotheses have been suggested to account for particular cases.

See Darwin's *Structure and Distribution of Coral Reefs* (1842), Dana's *Corals and Coral Islands* (1875), *The Atoll of Funafuti* (report of the coral reef committee of the Royal Society, 1904), and Wood-Jones's *Corals and Atolls* (1912). The work of Hedley and Taylor referred to above is summed up in 'Coral Reefs of the Great Barrier, Queensland' printed in the 1907 *Report* of the Australasian Association for the Advancement of Science. E.A.B.

Coral Cod. See ROCK COD.

Coral-fishes, members of the family Chaetodontidae, in which are included some of the most brilliantly ornamented of all fishes; their colours are often arranged in extraordinarily bizarre patterns which evidently serve as recognition-marks to enable an individual of any one species to find its fellows. They are plentiful among coral reefs, where the colours of almost every living organism may be gaudy to the point of garishness, but their striking contrasts of blue and orange, black and gold, or scarlet and green, render them conspicuous even in such gorgeous surroundings. The young of many have large black eye-spots (ocelli) upon their fins, which apparently afford them protection by scaring away larger enemies; a foe in search of food observes what seems to be a large eye peering steadily at it from among the coral branches, and, suspecting danger in such an unblinking gaze, makes off without further investigation. If this be correct, as may reasonably be supposed, such ocelli must be of great value to small and helpless fishes; and it is noteworthy that the young of many different kinds have them well developed, whereas they are usually lost as the fish grows and, being better able to look after itself, no longer needs them.

Chaetodons are mostly too small to be of value as food-fishes, though some reach a length of 12 inches. The snout is often produced into a longer or shorter beak, and the jaws are provided with projecting hair-like teeth to enable the fish to pick out from the crevices of the coral the small organisms which form its food. A large number of species occur in the tropics, and a few stray southward into cooler zones; several specialized members of the family are permanent residents of the southern coasts of Australia. The batfishes and butter-fishes are tropical relatives of the coral-fish, and the 'old wife' and mado are cooler-water allies. All these are discussed separately. A.R.McC.

Cordia, a large (chiefly tropical) genus of the family Boragineae, three species of which are indigenous to north-eastern Australia. *C. myxa,* an ornamental tree with large, nearly orbicular leaves, extends to tropical Asia and is cultivated in many lands; it is the 'Sebesten Plum' of India, where the tender young shoots are eaten either as a vegetable or pickled. The kernel, which tastes like a filbert, is also eaten. From their mucilaginous properties, combined with a degree of astringency, they have been employed as pectoral medicines under the name of Sebestens. The bark is used as a mild tonic. The wood which is grey to light brown in colour, and soft, is said to have furnished the timber from which Egyptian mummy-cases were made. It is used in India for boat-building, and to make covers for Burmese cheroots. The viscid pulp of the fruit is made into birdlime; the kernel yields a marking ink.

Corella. See COCKATOOS.

Corkwood. See DUBOISIA and ENDIANDRA.

Cormorants, large aquatic birds belonging to the family Phalacrocoracidae and better known in Australia as shags. There are five species of which one, the Black Cormorant (*Phalacrocorax carbo*) is the same as the cormorant of Europe; the other four are peculiar to the Australian region. Two large, white-breasted species are found on the sea-coasts, one of them (*P. fuscescens*) being confined to Tasmania and the southern coast of Australia, the other (*P. varius*) occurring all round the

Australian coast-line and extending to New Zealand. Two other much smaller species usually frequent rivers, swamps, and lagoons; both of these occur also in the Malay Archipelago—one (*P. ater*) is entirely black; the other (*Microcarbo melanoleucus*) has a white breast.

Pied Cormorant
(*Phalacrocorax varius*).

Shags feed on fish, crabs, and crayfish, and there has been much discussion as to whether they should be destroyed in the interests of fishermen. Available evidence seems to indicate that on the sea-coast and large coastal estuaries they feed mainly on crustacea and slow-swimming, non-edible fishes, and thus are of benefit by destroying enemies of the principal food-fishes; on the rivers and swamps, however, where even rapidly swimming fish have little chance of escape, they undoubtedly destroy all kinds of fish. They are of benefit in irrigation settlements, as they feed on the freshwater crayfishes that make holes in the banks of irrigation channels.

W.B.A.

Correa, a genus of the family Rutaceae, consisting of shrubs endemic in Australia. The flowers are large, showy red, yellow, white, or green; calyx cup-shaped, 4-toothed or lobed; petals 4, adhering in a cylindrical tube (in some species separating as the flower expands). *C. alba* is a coastal sand-dune shrub with creamy flowers, especially adapted to withstand the harsh conditions of such a habitat, and valuable as a sand-binder. It was known as 'Cape Barren tea' in Tasmania, its leaves being used by sealers as a substitute for tea. It seeds freely, and is easily propagated. *C. speciosa* (Native Fuchsia, which name is also ineptly given to *Epacris longiflora* and to a species of *Eremophila*) is a pretty shrub with varicoloured flowers, shading from red to green, and in some varieties from yellowish-green to white.

Cape Barren Tea.

Corrodentia. See INSECTS.

Cost of Living. The average cost of living for a family or other group of persons obviously depends upon (*a*) the number of each age and sex included therein, and (*b*) the price of the commodities used by them. In Australia two comprehensive enquiries have been made into this subject by means of budgets. In the first 1500 people voluntarily undertook to keep records for a whole year—July 1910 to June 1911 inclusive; books were supplied to them, but only 212 satisfactory returns were received. In the second instance 7000 volunteers agreed to keep records for four consecutive weeks in November 1913; 7000 books and sets of instructions were supplied, but only 392 satisfactory returns were made. The returns gave the cost of living for families receiving incomes under £200 per annum, and for those receiving over £200 per annum. Reduced to 1911 prices by means of price-indexes, the various amounts of expenditure are shown in the table hereunder. The families consisted of 588 husbands, 592 wives or widows, 1635 children of all ages, and 216 other dependents—3031 persons in all. The table constitutes, therefore, an illustration of the actual expenditure in 1911 of a sufficiently large number of people to furnish a satisfactory indication of the distribution of expenditure for rent, food, clothing, fuel and light, and other items. The use of price-indexes to correct the 1913 results (both as regards expenditure and income received) so as to agree with the 1911 basis makes all the elements of expenditure comparable, as well as the income received. It will be seen that the expenditure in lines 2 and 3 is alleged to exceed the income received.

Marked differences were found to exist between both expenditures and incomes in 1911 and 1913. These are explained by the fact that the 1911 returns were received from widely representative sections of the community, and the 1913 returns mainly from members of trade unions.

Once the budget for a family of a given size has been ascertained for any one period, that for any other can readily be found by taking account of the relative changes in the price of commodities since the original investigation was made. A record of such changes is, therefore, essential; and it serves a wider purpose also, inasmuch as it affords a means of measuring the varying relation between the unit of money—the pound sterling—and the commodities which money can purchase.

The actual cost of living will of course vary with the quantity, quality, and price of the commodities used. Changes in quantity and quality constitute alterations in the 'standard of living:' these may be altered by the in-

dividual. Changes in price, on the other hand, he cannot control. In order to measure that part of the total change which is due solely to the altered purchasing power of £1, it is necessary to see that the 'standard' or 'regimen' used to ascertain the variation in purchasing power is the same for each occasion. Practically, the consideration must be restricted to such commodities as are identifiable in respect of quality, while the quantities are kept the same throughout. In this way the results given hereinafter have been obtained. The relative quantities used, ascertained from five years' records, are called 'mass-units;' it is, of course, immaterial whether these units are doubled, trebled, or multiplied by any number whatever, or whether they represent a day's, week's or year's supply. Whatever commodities and quantities are adopted at one date, however, must be used also at the date to be compared therewith. The entire group of commodities so used may be called the 'regimen' or 'composite unit' adopted. The principle of comparison is simple. If the composite unit costs at one date £10,

AUSTRALIAN EXPENDITURE ON LIVING.

Group.	Average No. in Family.	Date of Enquiry.	No. of Budgets.	Expenditure. Rent.	Food.	Clothing.	Fuel and light.	Other Items.	Total	Income Average.
				s. d.	£ s. d.	s. d.	s. d.	£ s. d.	£ s. d.	£ s. d.
Under £200 ...	4·12	1910–11	113	9 9	– 19 1	6 10½	2 2	– 17 7½	2 15 6	2 19 11
	4·80	1913	254	8 9	1 5 2	7 2	2 10	– 15 0	2 18 11	2 15 2
Average	4·60	.....	367	9 1	1 3 3	7 1	2 8	– 15 10	2 17 11	2 16 7
£200 and over	5·31	1910–11	99	17 1	1 8 0	13 10	3 5	2 9 4	5 11 8	6 11 5
	5·88	1913	138	13 1	1 14 0	13 7	3 7	1 7 7	4 11 10	4 16 0
Average	5·65	.....	237	14 9	1 11 6	13 8	3 6	1 16 8	5 0 1	5 10 10
General average ...	5·01	.....	604	11 4	1 6 6	9 8	3 0	1 4 0	3 14 6	3 17 10
Percentage of Total Expenditure from General Average.				15·19	35·58	12·98	4·01	32·24	100·00	.....

* 1913 income corrected to 1911 basis.

at another £12, and at a third £13. 5s. 0d, then what 1000 pounds, shillings or pence would buy at the first date could be bought for 1200 of the same money-unit at the second date, and for 1325 at the third date. If the first date is taken as a reference date, and 1000 as the initial price-index, the 'price-index numbers' of the second and third dates are 1200 and 1325. Price-index numbers, therefore, are a measure of the reciprocals of the value of the pound sterling, or of any other unit of money we choose to adopt.

City.	1901	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
Groceries and Food Combined																		
Sydney	917	964	936	1030	1012	1000	989	1124	1131	1156	1396	1520	1540	1549	1783	2148	1898	1703
Melbourne	965	945	925	995	949	960	935	1082	1024	1091	1411	1462	1412	1466	1620	2056	1901	1644
Brisbane	965	959	947	1023	983	1000	1018	1102	1042	1078	1373	1426	1406	1495	1762	2052	1812	1608
Adelaide	1028	982	951	1010	1025	1001	1020	1154	1119	1215	1487	1532	1445	1554	1719	2132	1906	1723
Perth	1184	1237	1197	1226	1212	1251	1346	1345	1267	1302	1483	1542	1505	1486	1772	2050	1995	1794
Hobart	1011	1047	1010	1055	1093	1073	1058	1190	1164	1212	1445	1523	1544	1635	1748	2162	2025	1794
Weighted Average* ...	972	980	955	1031	1006	1005	1000	1129	1095	1144	1416	1495	1472	1511	1716	2101	1902	1684
Groceries, Food, and House Rent Combined.																		
Sydney	893	934	926	986	989	995	1103	1114	1178	1206	1323	1394	1407	1427	1580	1847	1724	1634
Melbourne	870	878	875	926	905	942	950	1055	1051	1105	1277	1309	1294	1349	1481	1788	1737	1625
Brisbane	769	780	794	856	851	877	915	979	969	997	1162	1188	1181	1252	1442	1645	1511	1442
Adelaide	864	891	894	953	990	1008	1058	1157	1121	1143	1259	1285	1245	1335	1468	1756	1652	1574
Perth	1027	1023	986	1001	988	1023	1126	1154	1128	1143	1222	1266	1246	1239	1420	1617	1609	1495
Hobart	869	899	886	920	952	951	954	1042	1053	1090	1233	1278	1301	1356	1496	1837	1785	1651
Weighted Average* ...	880	902	897	951	948	970	1000	1101	1104	1140	1278	1324	1318	1362	1510	1785	1697	1600

* The weighted average may be taken as representing the result for the Commonwealth for most purposes.

By taking the mean of a large number of returns, price-indexes have been ascertained for **'food and groceries' and for 'food, groceries** and house rent' taken together. The results, when the year 1911 is taken as a basic year and the price-index for it is made 1000, are, for the capital cities of Australia, as shown in the foregoing table. The 'weighted averages' are the price-indexes for the capital cities taken together, due allowance being made for their respective populations. The results are given for 1901 and for 1906 to 1922 inclusive.

The figures given show the variations which have taken place in the purchasing power of one pound sterling. Increase or diminution in the indexes denotes the corresponding increase or diminution in the price of commodities. Thus, given price-indexes, we may readily compare the cost of commodities in different parts of a territory.

Instead of using price-indexes it is often convenient to put such results in a more popular form, stating the amount of money required to purchase what would have cost on the average 20s. in the basic year. In the table given lower in this column the results for Australia and New Zealand are shown in comparison in the manner indicated. They represent the weighted means of the capital cities of the commonwealth of Australia and the four chief towns of the dominion of New Zealand. The table indicates that in 1922 money had only about half the purchasing power that it had during the first decade of the present century. This depression of the value of the money-unit in relation to commodities generally is a world-wide phenomenon.

The cost of living may be investigated from another standpoint, that of food-value. When supplies are abundant, custom or preference

Year.	Food and Groceries only.		Food, Groceries, and House Rent.	
	Commonwealth.	New Zealand.	Commonwealth.	New Zealand.
	s. d.	s. d.	s. d.	s. d.
1901	19 4	18 11	17 7	18 8
1902	21 1	19 5	18 7	19 1
1903	20 4	19 3	18 2	19 1
1904	18 5	19 1	17 2	19 0
1905	19 8	20 2	18 0	19 11
1906	19 7	20 5	18 0	20 3
1907	19 1	20 2	17 11	20 1
1908	20 7	20 3	19 0	20 2
1909	20 1	19 9	19 0	19 10
1910	20 1	20 2	19 5	20 1
*1911	20 0	20 0	20 0	20 0
1912	22 6	20 8	22 0	20 6
1913	21 11	21 1	22 1	20 11
1914	22 11	22 0	22 10	21 7
1915	28 4	24 4	25 7	23 0
1916	29 11	25 9	26 6	24 0
1917	29 5	27 9	26 4	25 3
1918	30 3	30 3	27 3	27 1
1919	34 4	31 7	30 2	28 3
1920	42 0	36 6	35 8	31 8
1921	38 0	35 8	33 11	31 9
1922	38 8	30 10	32 0	29 3

* The year 1911 is taken as the basic year.

will probably always decide as to the choice of particular foods, but when dearness and scarcity prevail it may be necessary to modify the regimen to agree with available supplies. Hence the consideration of the values of commodities as foods (food-values) may often become of the first order of importance. For general purposes such values are appropriately based upon the protein, fat, and carbo-hydrate contents of the various food commodities and their energy-values, the last being measured by the kilogram-calorie, viz. the quantity of heat necessary to raise one kilogram of water 1° centigrade, at its temperature of maximum density (3.97° C.). The regimen used in the computation of price-indexes by the Commonwealth statistician is given in the table hereunder; the quantities of the various commodities are for an average family of five persons, equalling 3.65 man-units. These quantities and their calorific values are as follow:—

AUSTRALIAN PRICE-INDEX FOOD REGIMEN: 1 WEEK.

Commodity.	lb.	Calories.
Bread	21·1	24,813
Flour	6·7	11,062
Oatmeal	0·8	1,487
Rice	1·1	1,794
Sago	0·2	326
Potatoes*	20·2	6,917
Sugar	10·4	18,949
Jam	1·6	1,512
Raisins and Currants	0·6	872
Milk	16·9	5,493
Butter	2·1	7,560
Cheese	0·3	533
Onions	1·5	174
Eggs	0·6	374
Bacon, &c.	1·0	2,708
Beef	8·7	10,614
Mutton	7·5	9,803
Pork	0·8	1,500

* 20 per cent. is allowed for waste.

This gives a total of 106,391 calories per week for 3.65 man-units, which is equivalent to 4164 calories per man-unit per diem; made up from 107 grammes of protein, 136 grammes of fat, and 584 grammes of carbo-hydrates, the protein and carbo-hydrates being taken as yielding 4.1 calories and the fat 9.3 calories per gramme.

The food-values of the English board of trade regimen are less liberal:—

ENGLISH PRICE-INDEX FOOD REGIMEN: 1 WEEK.

Commodity.	lb.	Calories.
Bread	22·0	25,872
Flour	10·0	16,510
Potatoes	17·0	6,533
Sugar	5·33	9,712
Milk	12·1	3,933
Butter	2·0	7,200
Cheese	0·75	1,333
Eggs	1·5	936
Bacon	1·5	4,062
Meat	6·5	7,930

The above quantities represent a total of 84,021 calories for 3.65 man-units, or 3288 calories per man-unit per diem. This is made up from 90 grammes of protein, 94 grammes of fat, and 499 grammes of carbo-hydrates, calculated as above. The normal requirement of a man (normal man-unit), according to the board of trade report, is 3400 calories, made up from 100 grammes each of protein and fat and 500 grammes of carbo-hydrates; this, according to Atwater's standard, is needed by a man occupied at moderately active muscular work. For very active work the calories range from 3835 to 6745, for ordinary work from 3060 to 3480, for light work from 2110 to 2970, for

professional and business men from 2190 to 3285, for persons taking little or no exercise, destitute persons, etc. from 1725 to 2400 calories. It must be borne in mind, however, that the value of food does not depend wholly upon its protein, fat and carbo-hydrate constituents. It appears to be established that it must contain vitamines; if these are absent, a diseased condition, and even death, may supervene. Moreover, researches in Switzerland have shown that where the reaction of a food upon the intestinal tract affects the length of time during which it is subject to digestive processes, the question of residual waste may greatly modify deductions based on mere protein, fat, and carbo-hydrate contents.

It has already been pointed out that the Australian is more liberal than the British board of trade price-index food-regimen, and gives a larger food-value. They could be made identical in calorie-values by a mere increase of the British or diminution of the Australian quantities. Such an increase or diminution would, of course, affect the absolute cost of living, but would not affect in any way the estimation of the purchasing power of £1. It is the relation among one another of the mass units, and not their absolute values, that is alone important in estimating changes in the purchasing power of money. Thus the question of the commodity-purchasing value of money is quite independent of the question of the aggregate cost of living, though the ascertainment of the latter can be accomplished by means of the price-indexes, when it has once been fixed by an appropriate investigation based upon householders' budgets, or their equivalent, for a particular date.

Popular misconceptions exist as to the meaning of 'cost of living,' as applied to the determination of what has been called the 'basic wage' (see INDUSTRIAL LAW), and as to what is really meant by variations in the purchasing power of money. The 'basic wage' is assumed to provide for the normal needs 'of the average employee regarded as a human being living in a civilized community.' This wage was first fixed by a judicial decision in 1907, and the price-index numbers of the Commonwealth statistician have since been applied thereto in order to ascertain the wages which at given later dates have the same commodity-purchasing value. Thus price-indexes have been put to direct practical uses.

G.H.K.

Cotton. In 1845 Sturt the explorer brought back from the Barrier Range a plant of the cotton family—named by von Mueller *Gossypium Sturti*, and usually known as Sturt's desert rose—which, however, has no lint, but only a slight 'fuzz' on the seed-coat. The fact that a lint-bearing *Gossypium* is indigenous to Australia was not suspected until in 1817 John Dunmore Lang (q.v.) drew attention to the occurrence of such plants on islands off the north-eastern coast, and suggested that they might also occur on the mainland. But it was not until 1904 that the curator of the botanic garden at Port Darwin was able to report the discovery of a true lint-bearing cotton-plant, indigenous to the Wildman River district of the Northern Territory.

Attempts to introduce the cotton-plant of commerce date from the first white settlement. Phillip brought cotton-seed with him from Rio, and King grew plants from it at Norfolk Island, but, being quite ignorant of the methods of treatment, could make no use of the cotton when grown. When in England in 1799 he arranged for the supply of more seed and of a portable gin to treat the product; seed was obtained from the Bahamas and from the Isle of Bourbon, but in 1802 King had to report that climatic conditions near Sydney were unfavourable, and that a settlement should be made farther north, where both cotton and indigo could be grown, with maize as a side-line. The colonial office, however, felt that it had enough irons in the fire without experimenting in cotton. In 1807 Edward Luttrell, a free settler of 1804 whom King made assistant surgeon in the colony and Bligh surgeon of the *Porpoise*, reported to the colonial office (apparently in total ignorance of King's experiments) that the New South Wales climate was favourable to cotton-growing, and that 'it would be meritorious in any individual to send out both seeds and plants'; as, however, Luttrell also reported that there was not a good fleece in the country, and that the prospects of a trade in wool were hopeless, his evidence was worth little and was disregarded. Nothing more was heard of cotton-growing until Governor Darling—who had apparently been experimenting for himself—on 24 March 1825 forwarded to London a sample of Sydney-grown cotton 'which I flatter myself in point of either colour or staple is not to be exceeded. It is real Georgian.' This sample excited mild interest in London, since two men with West Indian experience promptly applied for leave to cultivate tropical products, including cotton, in the north of New South Wales: one of them, indeed, came out, procured a large supply of seed of the perennial (vine) sort, and in 1828 commenced operations, but the experiment was ended by his untimely death. Meanwhile a small experimental plot had been started by Robert Dawson, manager of the Australian Agricultural Company; he was suspended from duty in April 1828 and his plot disappeared with him. At the time both the Company and the settlers at large were mainly interested in developing the pastoral industry; all available labour was thus absorbed, and for the next 10 or 12 years the only cotton-growing done in Australia was in botanical gardens. During the forties, however, John Vaughan Thompson, inspector-general of government hospitals in New South Wales, raised good cotton at Moreton Bay, though he failed to make the industry profitable; his partial success stimulated the imagination of J. D. Lang, who was visiting the northern districts to investigate the possibilities of closer settlement there for his Presbyterian immigrants. Much impressed by specimens of cotton from Thompson's farm, and influenced by a few enthusiasts, he convinced himself that perennial cotton could be raised with commercial success by family labour in the Moreton Bay district. Cotton, therefore, was to be his instrument of colonization; he proceeded to London, published a little book on *Cooksland, the Future Cotton-field of Great Britain*, but received no support from the colonial office or from the cotton manufacturers of Lancashire. Undiscouraged, he brought about 600 'virtuous Presbyterians . . . to form the nucleus of a cotton-growing population for Great Britain in Australia and eventually, as I hoped, to give the death blow to slavery in America.' Unfortunately, the colonial government refused to grant land to his immigrants and only a few were able to take up cotton culture, notably Dr. Hobbs, one of the surgeons sent out in charge. In 1851 Lang returned to England, taking with him samples of cotton raised at various places

between Brisbane and the Hunter River, the value of which Manchester experts estimated at from 6d. to 2s. 6d. per lb. The first shipment of cotton in bulk reached Liverpool in February 1854. Throughout the fifties crops of Sea Island cotton were raised sporadically in the northern districts (only one attempt being made to cultivate the coarser varieties) but many circumstances militated against the commercial success of the ventures. There was no local market; transport costs were high; other crops were believed to be more profitable; suitable land was inaccessible to small farmers; labour was both scarce and expensive, and skilled labour—especially for picking—practically unobtainable; seed was badly selected, and different varieties were grown in the one field and mixed in the same bale; and there was an entire lack of suitable ginning machinery, the saw-gin which was introduced having destroyed the fibres of the more valuable cottons. However, the despatch of samples from time to time prevented British cotton manufacturers from forgetting that northern New South Wales was suitable for cotton-growing; and when the political situation in the United States threatened the loss of their customary cotton supplies their interest became more active. During 1859 the secretary of the Manchester Cotton Supply Association wrote to the governor of New South Wales, offering to find a market for all Australian cotton consigned to him. The colonial government thereupon offered prizes for the best specimens grown in the northern districts, and placed orders in London for supplies of seed. Soon after Queensland was proclaimed a separate colony the crown lands alienation act of 1860 provided for the issue of land orders, to the extent of £10 during the next three years and of £5 in the following two years, as a premium for every bale of good cleaned Sea Island cotton that was exported to England. Meanwhile the Manchester association had forwarded cotton-gins, three or four of Dunlop's manufacture being installed in Brisbane by a firm that was prepared to clean and ship cotton on growers' account; and a joint-stock company was formed at Maryborough in Queensland for cotton cultivation, though it was generally believed that, unless coloured labour could be secured, cotton would be more profitably grown as a subsidiary crop by small farmers than on the plantation system. When the American civil war broke out in 1861, and the Manchester mills were starved of their supplies, the agitation for the introduction of coloured labour into Queensland to meet the sudden demand for raw cotton increased. Efforts to secure Indian coolies being unsuccessful, Robert Towns (q.v.) in 1863 imported 67 Kanaka labourers to his plantation, and further importations were made during the following years (see IMMIGRATION RESTRICTION).

Stimulated by the high price of cotton on the British market, experiments in cotton-growing were made as far south as Goulburn in New South Wales (i.e. nearly 35° S. lat.), but without much success. During the period 1862-71 26,000,000 lb. of cotton were exported from Australia, the cultivated area increasing from 320 acres in 1862 to 10,974 in 1870 and 14,500 in 1871: then Queensland cultivators began to feel again the competition of the United States, and production dwindled until in 1888 only 37 acres were planted. The Queensland legislature tried to revive the industry by offering a bonus of £5000 to the first person or company who manufactured cotton goods to the value of that sum from fibre grown in the colony. The Ipswich Cotton Company thereupon established a factory and produced the goods, cotton cultivation in the West Moreton district being greatly stimulated by its operations, but in 1897 the firm was obliged to close down owing to financial difficulties. From these early attempts to establish the industry much valuable information as to the suitability of soil and climate for the different varieties of seed was obtained, and experiments were continued not only in Queensland—where in 1901 Dr. Thomatis obtained the hybrid perennial 'Caravonica'—but also in the Northern Territory and Western Australia. In 1904 the curator of the botanic garden at Port Darwin reported that, besides the native cotton found at the Wildman River, cotton-plants of cultivated varieties were known from other parts of the Territory. Cotton had also been grown successfully in experimental plots in Western Australia since the eighties. He pointed out that northern Australia had this great advantage over the American cotton belt, that the crop ripened in the dry season, thus obviating damage from rain and damp and much lessening the strain of picking.

The drought of 1902 induced the Queensland department of agriculture to encourage cotton cultivation, not only for the lint but also as a fodder-crop for emergencies. In 1903 a commission was appointed to ascertain whether cotton could be grown on a commercial scale by white labour; it reported that a profit could be made by farmers who cultivated it in easily worked areas of from 5 to 10 acres, but that large plantations were unsuited to Australian conditions. Moreover, it was unlikely that farmers would commence cultivation unless a minimum price was guaranteed them for several years. Federal enquiries about the possibility of cotton-growing in the Northern Territory made it evident that before anything was done there on a large scale an experimental station should be established at Port Darwin from which selected seed might be distributed to volunteer growers. The British Cotton-growing Association, formed in 1902, was not impressed by the possibilities of growing cotton with white labour, and decided to undertake no Australian adventures, though, if the State governments would prepare definite schemes, the association would supply seed and machinery. Enthusiasm thereupon lapsed; in 1907 the Commonwealth government offered a bounty of 10 per cent of the market value of cotton grown and ginned in Australia, but with very little result, only £420 being paid as bounty in seven years. The subject was reopened during the sittings of the Dominions royal commission in 1913. The British Cotton-growing Association then offered, providing the Australian governments concerned undertook to make experiments in cotton-growing over a period of three years, to contribute £100 per annum towards the cost, to provide seed for experimental purposes, to undertake shipment, marketing, etc., and to guarantee a minimum net price in Liverpool of 6½d. per lb. This offer did not apply to the product of perennial varieties, or to ratooned cotton (i.e. cotton produced on suckers from a previous year's crop), the association being of the opinion that these were unsuitable for spinning and gave every facility for an increase in cotton pests. The federal government agreed to make provision for the appointment of an expert to be attached to the Queensland department of agriculture to carry on such experiments, but the agreement lapsed. During the war the area under cultivation

in Queensland increased slightly, the total quantity of raw cotton received at the government ginnery being 9500 lb. in 1914 and 166,000 lb. in 1918. The chief deterrent to more extensive cultivation was the high cost of picking, especially as the pickers were unskilled. The Commonwealth Institute of Science and Research therefore interested itself in the possibility of devising a mechanical picker. A special committee was appointed in 1917 to carry out experiments, but the results were not satisfactory, as it was demonstrated that the use of such a machine would necessarily be limited to tractable varieties of cotton. During 1919, however, there were various indications that the price of labour in the United States and Egypt would considerably advance during the succeeding years. There was also a chance of developing a small but steady market in Australia, since the director of the Commonwealth arsenal was specially interested in the production of sufficient local cotton to supply the requirements of the cordite factory. The Queensland government, which from 1913 onwards had made an advance of 1½d. per lb. on seed cotton (increased to 2d. in 1918) and had ginned it on owners' account, guaranteed growers 5½d. per lb. for seed cotton of good quality up to July 1923: the Commonwealth government joined in this guarantee, and the British association insured it up to £10,000. British promoters were by this time convinced that profits could be made even with white labour, provided that pests were excluded and the best seed of the most suitable varieties used: they therefore organized a British-Australian Cotton-growers' Association, and erected modern ginning-plants at convenient centres, making further provision for the extraction of seed-oil and the manufacture of oil-cake. A spinning factory had already been established independently. The result of this fresh impetus is that the area under cotton in Queensland has increased from 72 acres in 1919 to about 35,000 acres in 1923, and the 1923-4 yield of unginned cotton was over 15 million lb. The guarantee for 1924 was 5d. per lb.; for 1925 it took the form of a series of rates from 5¼d. down to 3½d. according to quality. None of these guarantees held good for ratoon cotton. In spite of the high price of cotton in the world's markets these guarantees involved the Queensland government in serious loss, amounting in the two years 1922-23 to nearly £65,000; the Commonwealth shares part of this loss. In 1925 the Empire Cotton-growing Corporation, a British institution, decided to contribute £3000 a year to the maintenance of experimental plantations in Australia. Such plantations already exist in Queensland at Biloela, about 60 miles south of Rockhampton, and at Monal on the upper Burnett.

When cotton-growing began to revive in Queensland, T. L. Bancroft, a son of Joseph Bancroft (q.v.), undertook a series of experiments in hybridization in the hope of breeding a cotton-plant specially adapted to Queensland conditions. In 1924 he submitted to the Imperial Institute in London hybrids of Durango cotton with Eureka, Egyptian, and Sea Island: the Eureka-Durango sample was by experts there valued at a penny a lb. more than good Australian-grown Durango, and the other two hybrids at a slight advance on 'fully good fair' Sakellaridis. In view of the importance of Farrer's analogous work on wheats, these initial experiments with cotton deserve close attention.

See R. Harding's *Cotton in Australia* (1924) which is, however, undoubtedly optimistic.

Cotton-tree. See HIBISCUS.

Cotton-wood. See BEDFORDIA.

Cotula, a large genus of the family Compositae, consisting chiefly of herbs, dispersed over warm and temperate regions. The floral bracts are few, in two rows; marginal florets rayless; seeds flattened, occasionally winged, without pappus. *C. australis,* a flaccid herb with ferny leaves, is a common weed in our lawns. *C. coronopifolia,* a marsh 'daisy' with bright button-like flowers, has a wide range, chiefly coastal. The seeds when immersed emit a gelatinous mucus, which enables them to stick to the feet or feathers of ducks and other marsh birds, and thus secure distribution. *C. alpina* is a small, creeping, alpine herb.

Coucal. See CUCKOOS.

Coveney, CHRISTOPHER. See ART.

Cowanyoung. See YELLOWTAIL.

Cow-fish. See BOX-FISHES.

Cowled Polypody. See FERNS.

Cow-pea. See VIGNA.

Cowper, SIR CHARLES (1807-1875), born at Dryford in Lancashire on 26 April 1807, was a son of William Cowper (q.v.), colonial chaplain under Samuel Marsden. The father's profession was followed by a younger brother, WILLIAM MACQUARIE COWPER (1810-1902), who was born in Sydney on 3 July 1810, educated at Oxford (B.A., 1833; M.A., 1835), ordained in 1833, made chaplain to the Australian Agricultural Company at Port Stephens in 1836, principal of Moore College for six months in 1856, and dean and archdeacon of Sydney in 1858. He died on 14 June 1902.

Charles Cowper was brought by his father to Sydney when barely two years old, appointed to the commissariat department while still a lad, and in 1826 made by Darling (probably at the instigation of Archdeacon Scott) secretary to the Clergy and School Lands Corporation (for which see CHURCH OF ENGLAND). When this corporation was dissolved in 1833, and the lands it administered reverted to the crown, Bourke offered the young secretary the post of agent for those lands; but he preferred the freedom of unofficial life and the prospective prosperity of a squatter, took to breeding shorthorns, and occupied runs at and near Corryong on the upper Murray. When the colony in 1843 obtained representative government, he entered politics, contesting Camden unsuccessfully against Roger Therry, and was almost immediately afterwards elected to represent Cumberland; this seat he held until 1850, vacated it to contest Sydney against Lang and Wentworth, was defeated, and in September 1851 was elected for Durham and held that seat until the old legislative council was dissolved in 1856.

During this period he was particularly active in two directions. In 1848-9 he carried through the council vigorous resolutions against the revival of transportation; in 1852 was president of the anti-transportation league (see TRANSPORTATION), and represented it at the famous conference in Hobart—Henry Parkes considered him too 'mild, affable and benignant' for the leadership in that cause. A few years earlier (in 1846-9) he had taken up with great vigour the advocacy of railway construction in the colony, and was first president and manager of the Sydney Tramway and Railway Company

(1849-1853). These activities made him so prominent that he became a member of Wentworth's 1853 committee for formulating the new constitution, and of James Martin's 1855 committee on the powers and duties of the executive under responsible government. When the new constitution was granted, and it became necessary to elect a parliament, Cowper headed the poll for Sydney, coming in a few votes ahead of Henry Parkes. In the assembly he became leader of the 'Liberal' opposition, drove the Donaldson ministry from office in less than three months, held the premiership himself for six weeks, spent another year in opposition, and then formed a ministry (7 September 1857 to 26 October 1859) which in its many internal changes introduced to office James Martin, John Robertson and W. B. Dalley. After a nine-weeks interval (while William Forster tried his hand as premier) he took office again, at first as colonial secretary under John Robertson, then (from 10 January 1861) as premier with Robertson under him; from March to November 1860 he was in the council, but from 7 December was back in the assembly as member for East Sydney, a seat which he held until 23 February 1867. His 1861 ministry lasted until October 1863; in a fourth term of office (3 February 1865 to 21 January 1866) he changed his treasurer twice and had two attorney-generals, two secretaries for lands, and two for public works; in a fifth (13 January to 15 December 1870) he again took over the premiership from John Robertson —during this last appearance in the assembly he was member for Liverpool Plains. Then, leaving politics, he took the agent-generalship, worked hard until illness incapacitated him, and died in London on 20 October 1875.

This mere record of his political positions is some indication of his character. Henry Parkes many years later described him thus:—'He had a familiar acquaintance with the affairs of the colony, quick insight in dealing with surrounding circumstances, and much good humour and tact in dealing with individuals. His political adroitness was such that it secured for him the popular sobriquet of Slippery Charlie.' He was, in fact, the great opportunist of Australian politics: some of his cabinets resembled the series of balls that a dexterous juggler keeps continually in the air. He succeeded, however, in carrying several measures of high importance. In 1858 he was responsible for manhood suffrage, the ballot, and a municipalities act; in 1861 he fathered John Robertson's land act; in 1862 he abolished state aid to religion, and passed the real property (Torrens system) act; in 1865 he imposed the first *ad valorem* duties and took part in a conference with Victoria on border duties (see TARIFFS). His one spectacular failure —and that was only temporary—was his attempt to force the Robertson land bills through the council of 1861. It was a dying council, having been appointed in 1856 for five years only. Still, it felt strong enough to insist on serious amendments in the Robertson bills as sent up from the assembly. Cowper therefore persuaded the then governor, Sir John Young, to consent to the nomination of 21 additional members. But, when the new nominees attended a meeting of the council to be sworn in, the president (Sir W. W. Burton, q.v.) resigned his position and walked out of the building, followed by most of his fellow-councillors. Before another meeting of the council could be summoned, the five-year term ended, and the bills had to be held over until a new council was nominated.

When Cowper retired from active politics, his services to the colony were recognized by the presentation to his wife of the Wivenhoe estate, which had been purchased with public subscriptions for the purpose. Outside active politics he was mainly interested in education. In 1854 a committee of his forming recommended the incorporation of the Sydney grammar school; he also strongly supported the establishment of residential colleges affiliated to the university of Sydney. (K.C.M.G., 1871.)

Cowper, WILLIAM (1780-1858), born on 28 December 1780 at Whittington in Lancashire, after earning his living as tutor in a clergyman's family at Northallerton in Yorkshire and as clerk in the depot of the royal engineers at Hull, resigned this position rather than work on Sunday, and set himself to study for holy orders. In 1807 he was ordained deacon and made curate of Rawdon in Yorkshire; early in 1808 he met Samuel Marsden, then on the look-out for chaplains to serve in New South Wales. Marsden approved of him highly, the colonial office confirmed the choice, and at the end of the year Cowper was ordained priest and formally appointed assistant chaplain for the colony. On 18 August 1809 he reached Sydney in the *Indispensable*, and on the 19th took charge of St. Philip's church on Church Hill, where he remained for 49 years. The existing church was built under his direction. In 1814 he was solemnly rebuked by Macquarie for using an unauthorized version of the Psalms at morning service. His duties included regular visits to the hospital and gaol, and he attended at least 300 criminals on the scaffold. In 1818 Marsden reported that Cowper was very infirm and unable to discharge the duties of his office; in 1829 Darling described him as nearly worn out by his exertions and by the climate; but it was not till 1842 that he was able to obtain leave of absence and proceed to England. In 1843 the archbishop of Canterbury gave him the 'Lambeth' degree of D.D. Returning to Sydney in that year, he resumed work at St. Philip's, but in 1848 was made by Bishop Broughton archdeacon of Cumberland and Camden: in 1852 he acted as bishop's commissary during Broughton's absence in England. He died on 6 July 1858.

William Cowper had great force of character, and his fearlessness gave him much influence among the rougher elements of the community, as did his steadfast refusal to become a magistrate—a post which he considered incompatible with his calling. He heartily aided Macquarie in his endeavours to help the aborigines, and as an advocate of higher education actively promoted the establishment of the King's School at Parramatta and St. Paul's College within the university. His sons Charles and William are dealt with under COWPER, SIR CHARLES.

Cowries. See MOLLUSCA.

Cox, WILLIAM (1764-1837), born at Wimborne Minster in Dorsetshire on 19 December 1764 and educated at the local grammar school, joined the Wilts militia on the outbreak of war with France in 1793 and in 1795 obtained a commission in the army (ensign, 1795; lieutenant, 1797; captain, 1808). In 1797 he joined the New South Wales Corps as lieutenant, being appointed paymaster in 1798 before he sailed for Australia. The vessel in which he came out (the *Minerva*) also carried a number of the 'Irish Exiles,' among them Joseph Holt

(q.v.), and Cox found him a good adviser on farming matters. When, therefore, soon after his arrival (on 11 January 1800) he began to buy land at Brush Farm and Canterbury, he obtained the services of Holt as overseer, and through him procured information of a proposed rebellion among the Irish convicts. In 1801 he was the owner of 1380 acres, all of which he had purchased from private vendors; but these purchases so strained his credit that in 1803—when he owned, besides the land, about 100 cattle, 2000 sheep and '£4000 worth of trading property'—he was made bankrupt by the army agents in England and suspended from his military duties, his estates being handed over to trustees. In 1807 he was ordered to England to answer charges connected with this bankruptcy, but cleared himself of all suspicion, was restored to his regiment and given his captaincy. He returned to New South Wales to settle down as a farmer at Clarendon near Windsor and resign his commission. He kept clear of the Bligh mutiny, and was made magistrate at Windsor by Macquarie—for which appointment the settlers there publicly thanked the governor on 1 December 1810. About this time Cox's sons investigated the country between Windsor and Camden, where Thomas Jamison (ex-surgeon-general) had already a 1000-acre block that was afterwards Regentville; William Cox and his family took up 4000 acres south of him at Mulgoa, Gregory Blaxland settled just below them at Wallacia, and in no long time the John Blaxlands, father and son, acquired land eastwards at Luddenham. Cox had already done a good deal of road-making in the county of Cumberland when, after Blaxland's crossing of the Blue Mountains and Evans's extension of the new discoveries to the Bathurst plains (for both which see EXPLORATION BY LAND), Macquarie in July 1814 made him superintendent of the works for a new road over the mountains. Within six months he made 101 miles, and on 21 January 1815 reported to Macquarie that the road was completed. In April-May the governor traversed it with a party including his wife, Sir John Jamison, William Cox, Lewin the artist, Oxley, Evans, and Redfern, and signified his approval in the usual fashion by naming the pass down Mount York and the river just beyond it after the maker of the road. His general order of 10 June highly eulogized Cox, and his despatch to Bathurst of 24 June suggested that the road-maker should be made commandant of the Bathurst settlement until it was well enough established to leave it to the ordinary methods of local administration.

This appointment was never made, nor was a payment of £300 which Macquarie recommended at the same time. In May 1817 he was still entreating the colonial office to give him some answer about these recommendations. But Cox obtained the first grant of land made to a free settler in the new territory—a 2000-acre block, now known as Hereford, immediately across the river from the government township; on this in 1820 Bigge found 5000 sheep pastured, farm buildings erected, and experiments with artificial grasses in progress. Cox also busied himself with minor explorations, examining the Lachlan in advance of Oxley's journey of 1817 and transporting to the river-banks all stores, stock, and boats required for the expedition. His home, however, was still at Clarendon, and he was magistrate at Windsor for many years. Brisbane in 1824 recommended him as an original member of the proposed legislative council, but nothing came of this: only three of Brisbane's ten nominees were appointed. He died at Windsor on 15 March 1837. His family included some of the most enterprising pioneers of Australian settlement. His eldest son William had estates at Windsor and Muswellbrook; his second, James, settled at Clarendon on the Esk in Tasmania; a third was killed in Fiji; Henry, George Henry, and Edward pioneered Mulgoa on the Nepean, George and Henry afterwards settling near Mudgee, while Edward stayed at Mulgoa. George's brother-in-law, Archibald Bell, was the discoverer of the stock-route from Windsor to Bathurst and Mudgee (still known as Bell's line) which runs over the Kurrajong to Mount Tomah and behind Mount King George to the railway line at Bell and thence direct to Lithgow.

The Penrith-Bathurst road, which was Cox's most remarkable achievement, deserves description. His instructions were to commence at the ford of the Nepean and follow the track laid down by Evans (with such deviations as he might prefer) to 'a centrical part of Bathurst Plains.' The roadway was to be 12 feet wide, the clearing through timber 20 feet wide; his working party of 30, 20 of whom were convict labourers, was guarded by eight soldiers. On 18 July 1814 he made the first cutting down to the Nepean ford; on 14 January 1815 he was forming the roadway at Bathurst. The chief difficulty was encountered at Mount York, where the grades were so steep that he proposed to make only 'such a road as a cart can go down empty or with a very light load, without possibility of its being able to return with any sort of load whatever.' The actual gradient was 1 in 4, and for many years all carts had to be brought up the hill empty. Easier deviations were made in 1827 and 1829, and in 1832 an entirely new road down Mount Victoria was constructed by T. L. Mitchell and opened by Bourke. Cox's road, descending into Hartley Vale and doubling southwards to the Cox River behind Hartley, then ran SW. from Mount Blaxland to the head-waters of Jock's and Antonio's Creeks, crossed the Fish River near Hobby's Creek, and reached Bathurst by way of O'Connell Plains and the Campbell River crossing at White Rock.

Crabs, animals (mostly marine) belonging to two sub-orders—Brachyura and Anomura—of the order Decapoda and class Crustacea. The Brachyura (true crabs) are discussed here; the Anomura are dealt with under HERMIT CRABS, which are the principal Australian representatives of that sub-order.

The Brachyura are distinguished from other Decapoda by having the abdomen short and bent up under the body, where it lies closely adpressed in a shallow concavity. The front (anterior) part of the carapace possesses a process which passes downwards to form a septum between the inner pair of feelers (antennules), and joins below with a plate (epistome) above the mouth-parts. The sixth pair of abdominal appendages (uropods) is generally absent, rarely present as rudiments. The outer pair of jaws or mouth-parts (third pair of maxillipedes) are generally broad and flattened, forming 'folding doors' which cover the other mouth-parts. Five tribes are included in this large sub-order, all represented by numerous types on every section of the Australian coast, while a few specialized forms are found in certain inland fresh waters.

The tribe Dromiacea (sponge-crabs, etc.) is the most primitive of existing Brachyura. This is indicated by the retention of a vestigial pair of limbs on the first abdominal segment (somite) of the female, and often on the sixth abdominal segment in both sexes. Further, the gills are in most cases more numerous than in the other Brachyura. The last pair, or the last two pairs, of legs are dorsal in position, with hooked or prehensile claws; the mouth-frame is square. In this tribe are three existing families, two of which (Dromiidae and Homolidae) include numerous forms common in Australian waters.

In their young stages the typical sponge-crabs (family Dromiidae) resemble lobsters in many points of structure. Their bodies are thick and furnished beneath with false swimming-legs, and end in a fan-like expanded fin, adapted for swimming. But in the adult state, when the abdomen is reduced and bent under the body, the crabs become more or less sedentary in habit. The last pair (or the last two pairs) of legs are short and carried up over the back, where they serve to hold a mass of living sponge, half a bivalve-shell, or some other marine growth, which forms a cloak to protect and conceal the bearer; the mass is firmly secured by the nippers on the hinder legs, which are perfectly developed, sharp and strong, and are formed by the opposition of the terminal joints of each leg to prolongations of the last joints but one, as is usual in the normal claws of the hand. At the sides of the abdomen, wedged in between the tail-pieces (telson) and the last abdominal segment, is a pair of small plates which are the last vestiges of the hinder abdominal appendages (uropods) present in both Macrura and Anomura. These are lacking, even as rudimentary structures, in all other members of the Brachyura.

Sponge-crabs inhabit shallow and moderately deep water on sandy and muddy bottoms. Their habit of carrying sponges and other marine growths on their backs protects them from observation by their enemies, while the animals which provide the cloak obtain a better supply of water and the food contained in it than they would if they were stationary, and are apt to grow at a rate which, if uncontrolled, would make them envelop their bearer. The crab, therefore, prunes off portions that grow where they are not required. During the process of moulting (ecdysis) common to all crustaceans, the crabs have to shed attached growths along with their shells, but probably select choice cuttings from their old coverings and re-establish them on the new shells.

The Bristled Sponge-crab (*Cryptodromia octodentata*), widely distributed in shallow waters off a great length of the eastern, southern, and western coast-lines, is characterized by the possession of strong bristly hairs that completely cover the body. When captured, it is often free from any protective covering, and the carapace is bare save for an accumulation of silt, etc., intermingled with the hairs. The Shaggy Sponge-crab (*Dromidiopsis excavata*), is commoner than the last-named species, but has a similar range and distribution. Great quantities have been trawled off Montague Island and Eden on the New South Wales coast, and off many parts of the Victorian coast farther southward. Though it commonly utilizes a sponge for its covering, this crab may adopt a compound animal colony of ascidians (sea-squirts), which is fleshy and jelly-like in appearance. Both the above crabs are drab brown in colour, and, like their allies, appear quite lifeless when taken from their homes on the sea-floor. It is possible that this is a result of conscious action, by which

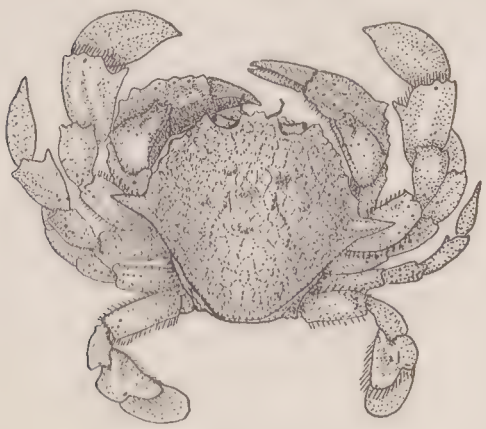
Bristled Sponge-crab, with half of body denuded. (about ⅓ natural size).

the crabs hope to evade detection. Many other species of the family occur in Australian waters, the tropical regions harbouring a great variety of small forms.

To the aberrant family Homolidae belongs the Slender Crab (*Latreillia australiensis*), which occurs commonly in deep water off the coasts of New South Wales and eastern and southern Victoria. In the triangular shape of the carapace, and the length and slenderness of the legs, as well as in its habit of living among the branches of seaweed and other marine growths, this crab superficially resembles some of the spider-crabs of the tribe Oxyrhyncha. The slender crab is pinkish in colour, mottled with spots of red. The few members of the Homolidae do not disguise themselves with coverings of other animals, as do the Dromiidae.

Members of the tribe Oxystomata may be recognized by the triangular shape of the mouth-frame, which is narrowed in front and extends forward between the eyes. They have their gill-openings placed very near the front of the carapace—an arrangement correlative with their general characteristic habit of concealing themselves in the sand, where they lie buried with only the eyes exposed. Four families make up the tribe, all of which include representatives common to our fauna. Typical members of the family Calappidae are not a little remarkable in appearance. This is partly due to the form of the carapace, which is much narrowed in front but widened behind, with shield-like expansions over the bases of the legs. More singular, however, is the development of the nipper-limbs (chelipeds), which have a very flat, crested hand of great size, the whole limb being so arranged that the pair can be concealed beneath the body—to which, in that position, they supply a sort of operculum or incomplete ventral carapace. These box-crabs, as they are sometimes called, are confined mostly to the tropical and subtropical zones, rarely occurring farther southward. The commonest species is *Calappa hepatica*, remarkable for the extraordinary speed with which it burrows; it lives in shallow water upon sand-flats, where it lies buried in the sand, and can only be detected by the presence of its eyes protruding from the surface. If approached, it will scurry away with extreme rapidity, and after running a short distance, will turn and face its pursuer, at the same time burrowing backwards with lightning speed into the soft sand. In the dawn-crabs (*Matuta*) the adaptation for swimming attains its highest development. All four pairs

of legs are formed for swimming, and have broad, flattened terminal joints, which are used as paddles as well as for burrowing; moreover, in the last pair the oval terminal joint is supplemented by a very broad expansion of the preceding joint. Strangely enough, none of the limbs are fringed with hairs, as is usual among swimming crabs; such a fringe would interfere seriously with the digging powers of the sharp points and edges of the terminal joints. As it is, they disappear under the sand in a moment,



Dawn-crab (*Matuta picta*)
(½ natural size).

and before the troubled water has cleared over their departing forms all traces of them are smoothed and lost. Their movements beneath the sand may sometimes be perceived under the feet of a person walking along the shore. Several species occur along the tropical and temperate zones of our coast-line, and commonly frequent open and shallow ocean beaches.

The family Leucosiidae is represented in Australian waters by several genera, commonly called pebble-crabs; they are remarkable for the extraordinary thickness of their carapaces, which are often highly polished in life, and beautifully marked. The pincer-bearing limbs are sometimes ridiculously elongated, and give the crabs a grotesque appearance. Most of the more striking forms are only secured by dredging, but in tropical regions pebble-crabs commonly inhabit the shallow waters of the reefs. *Ebalia crassipes* is common along the south-eastern coast-line, while tropical and subtropical districts are inhabited by many representatives of the typical genus *Leucosides*, among them the handsome *Leucosides longifrons*.

In the frog-crabs (Raninidae) some of the abdominal segments (somites) are visible from above—as is the case with the other family (Dorippidae) of the same tribe, and the last pair of legs is elevated on the dorsal surface. The legs, however, are flattened and paddle-like, and appear to be used for swimming and digging. The family includes about nine genera, which occur chiefly in tropical regions, and descend to depths not exceeding 300 fathoms. A species called *Ranina ranina*, a typical Australian member of the family, occasionally wanders as far south as Port Jackson. In general appearance it is one of the most striking and aberrant of the Brachyura. Its carapace, which has been compared to an inverted triangle, is very broad anteriorly, but the sides slope very gradually to the rounded hinder margin. Another smaller form is *Lyreidus tridentatus*, which occurs off the Queensland and New South Wales coasts, and has often been taken by trawlers in a depth of about 75 fathoms. Its range extends from Japan southwards to the New South Wales coast.

In the tribe Oxyrhyncha the carapace is usually triangular in shape, narrowed in front, and produced to form an anterior projection or rostrum. As a rule, the legs are long and slender. This tribe of sharp-snouted crabs includes a great number of species that are generally sluggish and inactive; many mask themselves with seaweed, sponges, etc., others have the shape of their carapace modified to resemble their surroundings.

The members of the family Maiidae, commonly known as spider-crabs, are the typical Australian representatives of the tribe. One of the commonest Australian species is *Hyastenus diacanthus*, which has a wide range along our eastern shores, occurring very plentifully in bays and river estuaries, where it is fond of inhabiting the water over muddy bottoms. This crab is nearly always completely hidden under a luxuriant growth of marine life, and from its habit of attaching living sponges to its carapace, is commonly known as 'sponge-crab,' though it is far removed in both appearance and affinities from the true sponge-crabs (Dromiidae). On close examination it will be found that the mass of living growths is attached to the crab's back by means of numerous hooked hairs, which are embedded in the substance of the hard carapace. If an example of the species could be secured immediately after it had cast its shell, it would be found covered with a thick coat of these hairs; but their tips, instead of being curled over, would be almost straight. Soon, however, they would begin to curl and twine like the tendrils of a vine round the stems of marine growths placed there by the crab, and in so doing would harden. The seaweed-crabs of the genus *Naxia* are also very common, but prefer clearer water, and are often seen at low tide in shallows on the rocky reefs of the open coast along most of the eastern and southern shores of the continent. They always live in association with seaweeds, and cover themselves with a thick growth, which makes them hard to detect. The Harlequin-crab (*Camposcia retusa*), from our tropical coasts, is possessed of a very dense growth of hairs, which it utilizes for the attachment of a marvellously varied assortment of marine growths; these, when living, cover it with a coat of many colours, and effectively hide it from the many enemies that abound among the coral reefs where the crab makes its home.

Crabs belonging to the tribe Cyclometopa have the carapace as a rule broader than long, with the antero-lateral borders convergent. The front is not produced into a rostrum. With the exception of a single family (Potamonidae, which includes the river-crabs), all the very numerous members of this tribe inhabit the sea, and many are familiar littoral forms. It includes several families which frequent our shores, but only three of the best-known are mentioned here.

In the large and very varied family Xanthidae the carapace is usually transversely oval, and its surface is often lobulated. The species of this family are very abundant along the littoral, especially in the tropics. In life many are vividly coloured, as is usual among tropical animals. The Giant Tasmanian Crab (*Pseudocarcinus gigas*), on account of its huge dimensions, is the most striking member; it may measure as much

as 13 inches across the carapace, and turn the scale at 20 pounds, while the hand may be 17 inches long from its base to the end of the large nippers which it supports. It is fairly common in depths of 50 to 80 fathoms off the eastern coast of Tasmania, and in the Great Australian Bight; occasionally it wanders as far northward as the southern section of the New South Wales coast, where trawlers have obtained a few examples. When hauled on board ship these crabs are almost paralysed, owing to the sudden reduction of the great pressure under which they are accustomed to live, and may be handled with impunity. Under natural conditions, however, they must be formidable enemies, armed as they are with huge nippers sufficiently powerful to crush a man's wrist. In life they are beautifully marked with blotches of rich red on a porcelain-white ground. As an article of diet the flesh of the giant Tasmanian crab has been highly esteemed by the few persons fortunate enough to try its quality. A. R. McCulloch states that many specimens trawled off Babel Islands in Bass Strait by the Commonwealth trawler *Endeavour* in the early part of 1914 were highly esteemed by the crew as delicate articles for the table, their massive limbs supplying an abundance of white flesh.

Swimming-crabs, the typical members of the family Portunidae, may be recognized by the flattened, paddle-like form of their last pair of legs. The Blue Swimming-crab (*Portunus pelagicus*) and the Mangrove-crab (*Scylla serrata*), the largest Australian members of the family, are well known and highly appreciated as food delicacies by residents on the coast. *P. pelagicus*

Giant Tasmanian Crab
(about one-fifth natural size).

occurs throughout the temperate and tropical waters of both the Pacific and the Indian Oceans, and is fond of frequenting shallows in bays and river estuaries, where it is secured in seine nets along with hauls of fish, and is commonly offered for sale in seaboard cities. In colour the species is beautifully mottled with blue. It possesses a sharp elongated tooth on each side of its carapace, which, together with the spines on its nipper-limbs, make it an awkward beast to handle when alive. The mangrove-crab is the larger of the two, and has a pair of heavy nippers, the fingers of which are jet-black; the rest of the shell is smooth, and earth-brown in colour. The species ranges from Sydney to Japan. It is very plentiful in northern Queensland waters, where it infests the mangrove swamps; the aborigines with the aid of canoes and spears procure great quantities in a short space of time. In Sydney shops it is not infrequently offered for sale along with the commoner blue swimming-crab. A smaller relative is the Periscope-crab (*Podophthalmus vigil*), which is worthy of mention on account of the great length of its eye-stalks—a feature quite unusual among the Cyclometopa. This species congregates on muddy flats on the northern Queensland coast, where it moves about more or less buried in the ooze, often with only its eyes projecting above the surface, on the watch for impending danger.

The river-crabs (family Potamonidae) are represented in Australia by some species of the genus *Geotelphusa*. These are freshwater forms; some live entirely in the water, others lead a more or less amphibious existence, and burrow freely in damp earth on the banks of streams and waterholes. They are widely distributed throughout most of the freshwater systems of northern Queensland; one species (*G. leichhardti*) ranges as far south as western New South Wales (where it is somewhat rare) and as far west as the Northern Territory.

In the tribe Catometopa the carapace is typically more or less quadrate, with the front

strongly bent downwards. Some representatives live on the land or in fresh water, but the greater number occur between tide-marks on the shore, and in the deeper waters of the sea. Only a few representatives of the true land-crabs have been recorded from Australia. The two best-known families of this tribe represented in our fauna are the Grapsidae and the Ocypodidae, notes on which may be supplemented by a general mention of the interesting members of the Pinnotheridae. Crabs of the family Grapsidae are the typical members of the tribe Catometopa. They have the carapace nearly quadrilateral in shape, with the front very broad, and the orbits situated near the antero-lateral corners. Many species are estuarine or fluviatile in habitat, and almost always littoral or shallow-water forms, with a rare exception in deep water. The commonest shore crab on the Australian coast is the Rock Crab (*Leptograpsus variegatus*). Examples of this species are to be seen scampering about everywhere along the shore-line of the southern half of the continent, rapidly seeking a safe hiding-place as an onlooker approaches. They are very audacious and cunning, and jump from rock to rock in a manner approached by but very few other crabs. Writing of the voracity of an allied species occurring on St. Paul's Rocks in the Atlantic, Charles Darwin noted that it was amusing to watch how quickly these large and active crabs, which inhabited the crevices of the rocks, stole the fish from the nests of the terns so soon as the parent birds were scared away by his party. Even the young birds were dragged from the nests and devoured. This habit, however, has not yet been recorded of the Australian species. The rock crab can live partly out of water, and is often under damp rock ledges above high-water mark, while it frequents both salt and brackish rock-pools. In crevices it moves around freely in search of food, gripping firmly to the barnacle-covered perpendicular walls of its habitat, and defies dislodgment by the force of the waves. Large specimens of the species may measure up to two inches in breadth of carapace.

The genus *Sesarma* includes a very large number of species, confined mostly to the tropical regions. They are strong, active crabs, with more than ordinary powers of defending themselves. A form known as *S. mienerti* is common on the Queensland coast, and exemplifies the strong build of its kind in the power of its claws and the strength of its legs. The latter are provided towards their tips with numerous stout hairs, which are directed downwards so as to offer resistance to the soft mud upon which the crabs live. They spend their time largely out of water, and inhabit mud-flats at the very highest limits of the tide, often venturing into the branches of mangrove trees, where they climb about in search of food. The species of *Sesarma* are remarkable in possessing a very elaborate breathing apparatus which enables them to remain a long time out of water. On each side of the body is a grill-like structure covered with fine hairs and arranged in definite series; the oxygen in the water contained within the gill-chambers when the crab leaves the sea soon becomes exhausted by the ordinary process of breathing, but is replenished when the water is spread in a thin film over this grill arrangement. The same water can therefore be utilized again and again by a crab until evaporation demands the creature's descent to its native element.

In the family Ocypodidae the front is generally narrow, and the eye-stalks are often very long. Most of the species are amphibious shore-crabs, and some have extremely wide ranges. Several species of the typical genus *Ocypode* occur in Australia, and are very common on most sandy shores in the tropical regions. These sand-crabs often congregate in vast numbers, and, as their generic name implies, are very swift of foot. On wind-swept stretches of sandy beach they appear rather to be borne on the wings of the wind than to run. They dig into the sand with their compressed lance-like fingers, and excavate burrows which may be as much as four feet deep; from these they wander far in search of food when the tide is out. While engaged in these hunting excursions the crabs are ever on the watch for possible danger, and every now and then stand high on their legs, raise their stalked eyes, and look carefully round. At the slightest movement they make for the nearest burrow, or, if the danger is too close, press themselves flat on the sand until an attempt is made to seize them, when off they dart. When running they carry their bodies high, doubling and dodging with such speed and cunning that it is a difficult matter to capture them. When the tide comes in, the crabs which have their holes below the high-water line are enclosed in their flooded burrows; so soon as the waves retreat again, they may be seen busily employed in clearing them, dexterously shovelling out the wet sand and heaping it at some little distance off. Species of *Ocypode* are said to feed upon many of the small lower crustaceans which commonly live in the sand, lying in wait and suddenly springing upon them much as a cat catches mice. They also feed upon dead fish and other animals that are cast on the shore by the waves. Though the gills of the sand-crabs are well developed, they do not nearly fill the large gill-chambers, and the creatures soon drown if kept under water. They breathe perfectly on land by means of a thick vascular lining of the gill-chambers, while two special apertures for the intake of air are developed between the bases of the second and third pair of walking legs; their openings are protected by a thick tuft of long,

Swift-crab (*O. ceratophthalma*), (one-third natural size).

peculiarly formed hairs, which act as a filter to prevent the entrance of sand grains and other foreign matter into the gill-chamber, while allowing the free passage of the air. On the inner edge of the larger hand, in most of these crabs, is a row or keyboard of fine teeth, which, when the arm is flexed, can be made to play against a similar ridge near the base. This produces a shrill grating sound, and serves among other uses to warn intruders that the owner of a burrow is already at home. The two commonest Australian species of the genus are *O. ceratophthalma* and *O. cordimana*, which are often found in association on the same stretch of beach.

The calling or fiddler crabs (*Uca*) inhabit the

shores of our warmer seas, and are particularly abundant in muddy estuaries. They are great burrowers, and live in vast numbers between tide-marks in salt-marshes and on mud-banks, which are often riddled with their holes. The adult male has one hand enormously increased in size, the other is quite small; the female has hands of equal size, similar in structure to the male's small hand. When feeding the males use the small claw only for picking up food, the females use either claw indifferently. The great hand of the male is always brilliantly coloured; its principal value seems to lie in its formidable appearance, since it seems to be a considerable hindrance to the crab's movements, and is so unwieldy that its owner can inflict but little harm with it. Males may be seen at the mouth of their burrows with the large hand in constant motion, as though beckoning to attract the attention of a female—hence their name, 'calling' crabs. One species has been observed to burrow by digging up pellets of sandy mud, which are carried under three of the ambulatory legs of one side; the crab climbs up the burrow with its load by means of the remaining legs, looks cautiously round from the mouth to make sure the way is clear, and then runs quickly to a distance of four or five feet before dropping the excavated material. The creature works in this way whenever the tide is out and the weather is suitable, both at night and in the brightest sunshine. The principal Australian species of the genus are *U. dussumieri*, *U. marionis*, *U. tetragonon*, and *U. coarctata*. The last-named is remarkable for its brilliant colouring. The back is glossy black; the huge claw, the under-surface of the body, and all the other limbs, are the most brilliant scarlet vermilion, inclining to crimson.

The famous Army Crab (*Mictyris longicarpus*) is also included in the Ocypodidae. This species is very plentiful on extensive sandy stretches in the bays and estuaries of the eastern coast. When the tide is high nothing is seen of the crabs. Shortly after the tide recedes, however, armies of them rise up as if by magic from the previously barren sand, and, assembling in battalions, march in open order, the separate companies seeming to move in definite directions, as though amenable to strict military discipline. Male individuals often lead the van of these moving battalions, and seemingly fulfil the duties of commanding officers. If followed by an observer, they continue their march at an accelerated pace; if overtaken or pressed hard, they disappear beneath the sand almost as suddenly as they emerged. On the other hand a whole crab-cavalcade may retire before a close pursuer right across a sand-flat, and disappear in the shallow water at its edge. The colour of the army crab's body is usually pale blue or lilac, and the limbs light flesh colour. The structural peculiarities of *Mictyris* distinguish it from all other crab genera, and explain the singular celerity with which its members burrow into the sand. The body is almost globose in shape, but more dilated above; the external maxillipedes (foot-jaws) are wonderfully developed, and protrude from the other mouth-parts in the form of a comparatively huge half-sphere. When burrowing, their narrowed bases are driven foremost, a spiral motion is communicated to the body by the action of the walking-limbs and claws, and the complete organism thus constitutes itself a sort of animated centre-bit.

From remote antiquity certain little crabs of the family Pinnotheridae have been found living within the shells of bivalve molluscs, such as oysters, mussels, and especially the large mussel-like shell *Pinna*. Ancient writers regarded this as a case of association for mutual advantage, believing that the crab warned the *Pinna* of the approach of enemies, or of the entrance of prey between its gaping valves. It is even stated that the *Pinna* and crab were depicted in Egyptian hieroglyphics to symbolize the dependence of a man on his friends. There is no reason to suppose, however, that the molluscs which harbour the *Pinnotheres* and some allied genera benefit in any way by the presence of the crabs. The latter probably feed, as their hosts do, on particles brought in by the current of water entering the mantle-cavity. They are therefore strictly 'commensals,' though it is usual, and perhaps equally correct to speak of them as 'parasites'—the case is, indeed, an example of the difficulty of defining these terms. Pinnotherid crabs show one of the characteristics of parasites in being to some extent degenerate in their structure. The carapace, no longer needed for protection, has become soft and membranous, the large chelipeds are reduced to diminutive proportions, and in the typical genus *Pinnotheres* the eyes and all the antennal, ocular and mouth-parts, so important to a free-living crustacean, are reduced to almost rudimentary structures. The males are usually smaller and less modified than the females, and move about more freely. As in many parasites, also, the eggs produced by the females are very numerous, and the abdomen is very broad and deeply hollowed out for their reception. Two or three crabs may be found in the one mollusc. A member of the typical genus (*P. villosulus*) is found on the northern coast of Australia as a commensal of the pearl oyster. Another species (*Xanthasia murigera*) takes up its abode in several kinds of clam on the reefs in our warmer waters. The 'mutton-fish' univalve (*Haliotis asinina*) harbours *Pinnixa faba*, which may be found on the coast as far south as New South Wales, but is more common farther north.

F.A.McN.

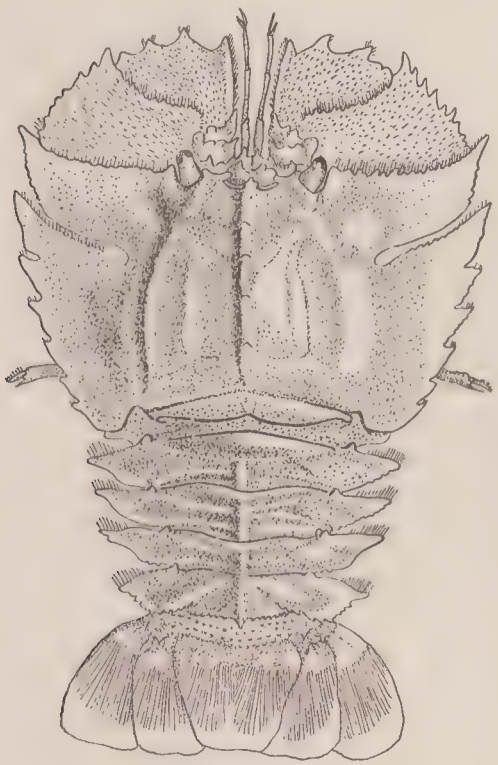
Crab-tree. See PETALOSTIGMA.

Crakes. See RAILS.

Cranes. See NATIVE COMPANION and HERONS.

Crayfishes, animals belonging to three tribes of crustaceans—order Decapoda, sub-order Macrura—which include the marine crayfishes (usually known in Australia as 'lobsters,' but only distantly related to the European lobster), the yabbies and freshwater crayfishes, and the prawn-killers. Among the marine crayfishes (tribe Loricata) none of the legs bear nippers (chelae). Specimens of both the families into which this tribe is divided are common along the Australian coast-line. In the family Palinuridae the body is more or less cylindrical; the antennae are long, round, and jointed. The other family (Scyllaridae) is remarkable because the antennae are modified into the form of broad flat plates, which appear as shovel-like attachments protruding from each side of the front part of the head; these are said to be used in burrowing. Among the commoner varieties of the Palinuridae two (often called in the trade 'crawfish') are the mainstay of the crustacean industry of the Commonwealth, and are sold all the year round in the markets of the capital cities under the commercial name 'lobster.' The supply for the Sydney markets is primarily furnished by *Jasus verreauxi* (Spiny Lobster), which is abundantly distributed along the eastern seaboard from its

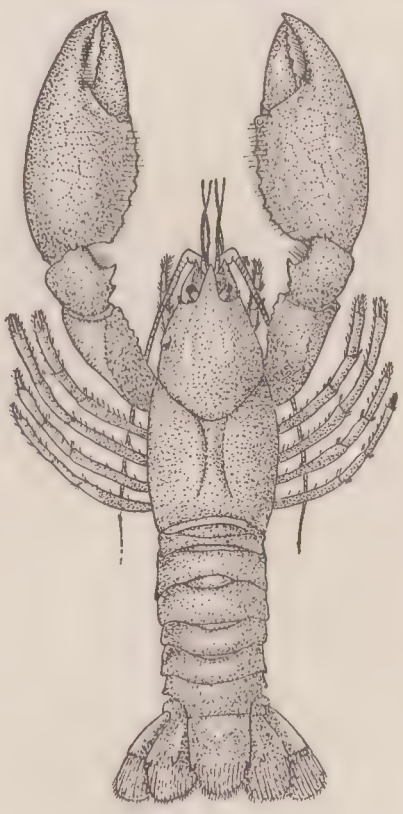
south-eastern extremity up to southern Queensland. Some specimens turn the scales at six pounds or more. The colour during life is a dark foliage-green. The principal catching-centres are Cape Hawke, Port Stephens, Broken Bay, Port Jackson, and the Shoalhaven bight. Shipments vary greatly in quantity, possibly because of the ruthless destruction of breeding females—a matter to which great attention has been given in countries such as the United States of America, where special laws provide for strict supervision in catching, and an unending supply is consequently always within reach of the consumer. The second species, *J. lalandii*, has a much wider distribution, and is more brightly coloured. Its range extends right along the southern half of the Australian coast-line, and it is common in Tasmanian waters. The supply on the eastern coast has been increased during the last few years by the liberation of batches of young from the fish hatchery at Port Hacking, near Sydney. The two commercial species are easily distinguished by the character of the upper plates (terga) of the segments of the abdomen; in *J. verreauxi* these are smooth but for the presence of tiny pits on the surface; in *J. lalandii* they are sculptured.



Prawn-killer.
(about ⅓ natural size).

Far north, on the eastern Queensland coast, some brilliant tropical species of the family occur, but rarely find their way to market. One of these is *Senex ornatus*, remarkable for the possession of colouring which harmonizes with other brightly-tinted organisms peculiar to the coral reefs that this species inhabits. The family Scyllaridae includes the broad-fronted crayfishes. One species, *Scyllarus sculptus*, has the same distribution as the spiny lobster, is found under the same conditions, and is often captured in 'lobster pots' along with the commercial lobsters; it is, however, smaller than these and does not occur in sufficient quantity to be of much commercial value. Confined, as a rule, to the deeper waters is *Ibacus incisus*, remarkable for its greatly depressed form and extraordinary lateral expansion of the carapace and antennae, which are deeply incised to form numerous sharply-pointed teeth. Great numbers of this species are secured by trawlers off the coast of New South Wales, when the ships are working over sandy bottoms. This 'prawn-killer,' as it is called by local fishermen, is of no commercial value, since it has very little flesh. Like *Scyllarus sculptus*, it is red in colour, but of a very much lighter tint.

Among the Nephropsidea are included the freshwater crayfishes, which have the first three pairs of legs pincer-like (chelate), the first pair being very large and formidable. All the Australian representatives are grouped in the family Parastacidae. Several genera and numerous species occur in Australia and Tasmania, and some of the larger ones are often used for food. They are specially remarkable for their variety



Yabbie
(⅓ natural size)

and their great size, the Tasmanian Crayfish (*Astacopsis franklinii*) being the largest crayfish in the world. It inhabits the creeks and rivers of northern Tasmania, where it grows to about two feet six inches in length, and may scale eight or nine pounds; the claws of large specimens are formidable weapons, about the size of a man's hand. It is excellent eating, being less coarse than the spiny lobster, but is difficult to capture and never appears in the market; the only people who eat it, or know anything about it, are a few

permanent residents in the localities where it occurs. In colour this giant is generally a uniform dense chocolate-brown, but it may be nearly black. Next in size is the Murray River Lobster (*Astacopsis serratus*), which commonly attains a length of eighteen inches, and is at times exhibited for sale in the Sydney and Melbourne markets. A remarkable feature of this species is its extraordinary range of colour variation. Specimens caught near Sydney are generally dark green, with blue and red markings; those from the Murray River and its tributaries are lighter in colour, with white hands; smaller specimens from streams of the Great Dividing Range are often quite red, as though they had been boiled. The Yabbie (*Parachaeraps bicarinatus*) is smaller than either of the last-mentioned species, rarely attaining a length of nine inches, but is the most widely distributed Australian member of the family, occurring over the greater part of the continent, and entering even the central desert areas. Chiefly found in the waterholes of the more sluggish streams, it is well known to settlers as an inhabitant of their artificially constructed dams, some of which are so far from permanent watercourses that it is difficult to understand how the crustacean becomes established in them. Like its allies, it excavates burrows in the banks surrounding the water it inhabits; unlike its allies, it has become a great pest, for its burrows often riddle the banks to such an extent as to cause them to leak, and later collapse. One can easily imagine the depredations of these creatures, when their attentions are directed to the small wells and springs which form the main water-supply of so many people in the interior. The yabbie affords an abundant food-supply to many of the larger wading birds of the western country, predominant among which is the white-fronted heron, often called 'blue crane' (*Notophoyx novae-hollandiae*).

Both this crayfish and the Murray River lobster retire to their burrows during dry seasons, and are said to be able to survive droughts by burrowing deeper than usual and forming clay-lined chambers capable of holding water for an indefinite period. The so-called 'land crayfishes' of the genus *Engaeus* also belong to this family, and are remarkably adapted for their particular mode of existence. A modification of their gill-chambers enables them to live largely out of water, and move freely on damp soil. Although independent of the actual presence of water, their burrows always occur in damp soil, and are exceedingly moist; they contain a kind of liquid mud in the chambers at their bases, wherein the crustaceans are usually found. These burrows are tubular, often reach a length of two feet, and may branch several times; when they fall in—a by no means infrequent occurrence—a 'crab-hole' is formed. In areas where the creatures occur their whereabouts is detected by the presence of large groups of mud cylinders, six to nine inches high, protruding from the surface of the ground; these are the external prolongations of their burrows, composed of dry mud. They differ from other crayfishes in having the tail portion much smaller, and adults attain a length of only four or five inches. Land crayfishes are common in parts of Tasmania, where they are known as 'land crabs;' their distribution also extends to Victoria, and they are found in the southern parts of New South Wales.

Crayfishes pass through their earlier metamorphoses while still encased within the egg; upon emerging, they remain attached to the swimmerets of the parent until they reach a well-advanced stage of development.

Members of the tribe Thalassinidea are burrowing forms with a soft, loosely-built body and a rather elongated abdomen. In some respects they form a transition to the Anomura (see HERMIT CRABS), in which group they are placed by some naturalists. The tribe is composed of three families, one of which, the Thalassinidae, includes a single form (*Thalassina anomala*), the largest and best-known of the Australian species. This crustacean occurs commonly along the coasts of northern Australia; it is especially characteristic of mangrove swamps, but is sometimes found burrowing in damp earth at a considerable distance from the sea. Although individuals are rarely observed, the large and conspicuous mounds of excavated mud which they form near their burrows are very plentiful. They are commonly dug out by the aborigines and utilized for food.

F.A.McN.

Cream of Tartar Tree. See ADANSONIA.

Creeping Monkey-flower. See SCROPHULARIACEAE.

Cricket in Australia looks back through almost a century of authentic history. Its introduction is usually attributed to the officers of the *Calcutta*, which arrived in Port Jackson at the end of December 1803; Macquarie in 1821 presented 12 cricket-bats and six dozen balls to Reddall's school at Macquarie Fields; but not until 1826 is there any authentic record of matches being played. In that year the Military Cricket Club was formed: it was followed soon afterwards by the Australian, Marylebone, Union, Currency and Victoria. There was much rivalry between the early clubs, and they missed no opportunity of putting their skill to the practical test of match play. There is evidence, however, of a gilt lining to the spirit of sport that no doubt dominated many of these games. The honour of winning one match, for instance, was enhanced by the fact that the participants played for £1 per bat and a dinner each, as well as a scorer's tent valued at £3.

The *Sydney Gazette* of 2 January 1830 refers to a match played on New Year's Day 'for heavy stakes,' and states that at 'four o'clock it was estimated that there were upwards of 100 spectators witnessing the contest.' The match was played on the racecourse, now known as Hyde Park. On 17 October another match was played on the same ground for £20 a side between the Marylebone and Australian clubs, the scores (the first on record in Australia) being—

AUSTRALIAN CLUB.	*Innings.* 1st	2nd	MARYLEBONE CLUB.	*Innings.* 1st	2nd
Wm. Brown . .	19	15	Jas. Hamilton .	1	1
Geo. Cavanagh .	12	0	Thos. Roberts .	0	2
Thos. Oliver .	3	0	Geo. Guest . .	6	14
— Rickards . .	0	3	C. Roberts . .	5	1
F. Stephen . .	0	33	M. Clarkson .	20	10
D. Hill . . .	1	0	H. Green . . .	17	1
S. Wall . . .	0	6	J. Beeson . . .	5	5
T. Broughton .	15	11	R. Trees . . .	11	9
W. Hill . . .	1	0	J. D. Nicholls .	15	17
— Gardiner . .	11	2	W. Roberts . .	7	2
— Carney . . .	0	2	— Scales . . .	0	5
Byes . . .	8	8	Byes . . .	6	10
	70	80		93	77

In 1830, too, 11 officers of the 39th regiment played 11 officers of the 57th regiment for £50 a side.

The customs and manners associated with these early games are interesting and noteworthy. The members of the Military team, for instance, play-

ed in tall black hats; the representatives of the Australian Club went into the field bareheaded, or wearing cabbage-tree hats with broad blue ribbons and streamers behind. Leg-guards and batting-gloves were not in use. The bowling was all underhand. Robert Still, a member of the Australian Club, and a native of Sydney, is said to have introduced a style of round-arm bowling that was very deadly; the credit of this innovation, however, is sometimes given to John and William Hardy, sons of Admiral Hardy. Of Still it is recorded that, because of the manner in which he 'threw' the ball, he hurt the players.

Enthusiasm soon extended beyond the mother colony, as is shown by the record of a match played at Hobart, in which an eleven drawn from H.M.S. *Hyacinth* and the 21st Fusiliers was defeated by a town team by 107 runs. This match itself might be considered the first international cricket match; but a more definite international prototype discovers itself in the match played at Hobart in 1837 between a Tasmanian team (drawn mostly from the Derwent Club) and a team of Europeans. The Hobart Town Club, founded in 1832, was the pioneer club in Tasmania, and its formation represents the first step in cricket organization there. In 1835 its name was changed to 'Derwent,' and as such it continued to hold a prominent place in the club cricket of Hobart for 70 years—until, in fact, the old clubs were superseded in 1903 by clubs founded on a district residential basis.

Sydney took the lead in establishing the system of district competitions, an organization which lies at the foundation of Australian skill in cricket. In Sydney, though the earliest clubs already mentioned flourished for some decades, not one of them has survived. The Currency Club, founded about 1840, was one of the most noteworthy for several seasons; it was entirely composed of native-born Australians, and in point of skill was far ahead of all its contemporaries. One of its founders was William Tunks, often referred to as the 'father' of good cricket in New South Wales; Harry Hilliard was also a prominent member. Of all early cricketing pioneers William Tunks is certainly most deserving of special remembrance. The Currency, however, like all the early clubs, was replaced by others, which in turn disappeared, or were superseded in 1893 by the district clubs of the present day.

In Victoria the story of club cricket is somewhat different; one club in particular stands out for its longevity, its increasing power, and its dominating influence upon the game. The Melbourne Cricket Club, founded in 1838, was reconstituted in September 1846 under the following officers:—*president*, G. Cavanagh; *honorary secretary and treasurer*, O. Gillies; *committee*, C. Burchett, A. A. Broadfoot, D. G. Campbell, F. W. Marsden, J. McLachlan and Hugh Walker. Thenceforward the club assumed in Victoria the leading position that it has maintained to the present day. Embracing as it does kindred sporting and social activities, it has now the largest membership (over 5000) of any cricket club in the Commonwealth. Up to 1910, when the visits of English teams to Australia and of Australian teams to England were placed under control of an Australian 'board of control for international cricket,' the Melbourne Club was, by virtue of its influence and wealth, a great factor in the promotion of international cricket. It survived the introduction of district cricket in Melbourne, and its representative eleven competes for the club premiership of Victoria on the same footing as those of the district clubs. Its cricket-ground, like that in Sydney (the only ground in Australia, and possibly in the world, which surpasses it), is crown land vested in trustees for cricket purposes; but, whereas in Sydney the trustees control the ground, in Melbourne they have leased it to the club, and it is managed by the club's committee. The authority of the trustees is, of course, paramount in any matter affecting the purposes for which the ground was dedicated.

For many years now the system of 'district' cricket competition, first introduced in 1893 in Sydney, has been firmly established in all the States; and it, and the organization at the back of it, are in large measure fundamentally responsible for the maintenance of a high standard of cricket in Australia. The other prime factor in keeping up the standard of play—the organization and conduct of representative cricket—presents two aspects for consideration, the domestic or inter-State, and the international.

The history of intercolonial or inter-State cricket begins with a match between Tasmania and Victoria, played at Launceston on 11 and 12 February 1851, which Tasmania won by three wickets. The scores follow:—

VICTORIA.

First innings.		*Second innings.*	
Cooper, b M'Dowall	4	b Henty	0
W. Philpott, c Maddox, b M'Dowall	17	run out	3
T. Hamilton, b M'Dowall	10	lbw, b M'Dowall	35
C. Lister, run out	10	c Maddox, b Field	3
A. T. Thomson, b M'Dowall	1	b Henty	0
R. Philpott, b Henty	12	c Westbrook, b Henty	1
Antill, st Marshall, b Henty	0	not out	0
J. C. Brodie, c Henty, b M'Dowall	17	c Tabart, b Henty	5
F. W. Marsden, b Henty	2	b M'Dowall	2
M. Hall, not out	6	lbw, b M'Dowall	6
M. Hervey, b Henty	0	c M'Dowall, b Henty	1
B 1, lb 2	3	Bye	1
Total	82	Total	57

	O.	R.	W.	O.	R.	W.
Henty	13	54	4	9	27	5
M'Dowall	13	28	5	5	21	3
Field	—	—	—	3	9	1

TASMANIA.

First innings.		*Second innings.*	
G. Du Croz, b Antill	27	b Antill	6
J. Marshall, c Lister, b Antill	13	c and b Antill	0
W. Field, b Antill	0	c Thomson, b Brodie	1
Dr. G. Maddox, b Antill	1		—
G. Gibson, b Hamilton	8	b Antill	1
H. W. Westbrook, b Antill	10	c Cooper, b Antill	4
C. Arthur, b Antill	1	c Hervey, b Antill	0
J. Tabart, b Hamilton	2	not out	15
G. Gibson, not out	7	b Antill	1
W. Henty, b Antill	0		—
R. M'Dowall, c Antill, b Hamilton	11	not out	4
B 11, lb 5, nb 8	24	B 3, lb 2	5
Total	104	Total (7 w.)	37

	O.	R.	W.	O.	R.	W.
Lister	12	32	0	—	—	—
Hamilton	8	30	3	—	—	—
Antill	12	42	7	6	21	6
Brodie	—	—	—	7	16	1

Antill bowled 2 no-balls and Lister 6.

The return match, played at Melbourne in March 1852, was won by Victoria by 61 runs.

'It was agreed' says the Melbourne *Morning Herald*, 'that the wickets should be pitched at half past eight that the game might commence punctually at nine o'clock. At one o'clock the bugle will sound for lunch when an adjournment from the field to the tents for half an hour will take place.'

Victory again rested with Tasmania in the third meeting at Launceston in March 1854. It is significant that Tasmania, splendidly successful in two of her first three intercolonial engagements, subsequently failed to sustain that relative superiority; though her first three matches take priority over the initial New South Wales-Victoria contest, the continuity, interest in, and importance of her intercolonial contests dwindled into comparative insignificance.

The most important inter-State matches are those between New South Wales and Victoria. The first of the long and unbroken series of matches between representatives of these two States took place in March 1856. It came about directly through an advertisement in a Melbourne newspaper, inserted by some leading players of the southern capital, offering to play an eleven of New South Wales for £500. The New South Wales players, at a meeting called by William Tunks at the Currency Lass hotel on 27 January 1856, gladly and unanimously decided to accept this opportunity of measuring their skill against their Victorian challengers, though they preferred to play for the honour of the game rather than for a stake. At the meeting Tunks expressed the general opinion that to play for money was detrimental to the spirit of true sport, as it encouraged gambling, and was liable to bias the umpires. He, as it appears, was mainly responsible for raising sufficient money to pay the expenses of the New South Wales team to Melbourne, where this epoch-making match was played. The sole survivor of the two teams, David M. Serjeant—who played the first ball in what has become the greatest series of purely Australian cricket-matches—has lived in London for many years and was knighted in 1922.

The scores were:—

VICTORIA.

	First innings.		*Second innings.*	
D. M. Serjeant, b McKone	7	b McKone	5
J. Mather, run out	16	b McKone	0
R. Coulstock, lbw, b McKone	4	c McKone, b Murray	2
T. Morres, b Gilbert	2	c Howell, b Murray	1
Capt. Hotham, b McKone	0	b Murray	0
C. Cumberland, c Bradridge, b Gilbert	2	run out	1
W. Philpott (capt.), b McKone	5	run out	11
P. O. Kingston, not out	12	b McKone	0
F. Lowe, b McKone	2	not out	1
A. Lewis, c and b Gilbert	8	b McKone	5
G. Elliott, b Gilbert	1	b McKone	1
Byes	4	Byes	1
Total	63	Total	28

	O.	M.	R.	W.	O.	M.	R.	W.
Gilbert	17	3	34	4	—	—	—	—
McKone	17	3	25	5	13	4	11	5
Murray	—	—	—	—	10	2	16	3

NEW SOUTH WALES.

	First innings.		*Second innings.*	
R. Murray, c Morres, b Elliott	0	b Elliott	5
W. Tunks, b Elliott	1	b Elliott	0
S. Bradridge, b Elliott	2	b Lowe	2
H. Halliard, lbw, b Elliott	0	not out	1
G. H. B. Gilbert (capt.), c Morres, b Coulstock	6	b Lowe	7
J. McKone, not out	18	b Lowe	0
R. Vauchan, b Elliott	0	not out	1
E. Saddler, b Coulstock	7		—
B. Beal, st Lowe, b Coulstock	0		—
R. Driver, b Elliott	18	b Lowe	0
G. Howell, b Elliott	11	b Elliott	0
B 3, w 9, nb 1	13		—
Total	76	Total (7 w.)	16

	O.	M.	R.	W.	O.	M.	R.	W.
Elliott	42	16	28	7	11	4	7	3
Coulstock	29	9	31	3	—	—	—	—
Morres	7	1	13	0	—	—	—	—
Lowe	—	—	—	—	9	3	9	4

Umpires: J. B. Bradshaw and C. F. Cameron.

A return match played at Sydney in January of the following year saw New South Wales again victorious by 65 runs. These contests have been carried through annually (with two interruptions—see below) up to the present time (1924-5), and have been characterized by a healthy spirit of rivalry without parallel in Australia, and equalled only in the annual meetings of the rival roses—Lancashire and Yorkshire—in England. In the 1874-5 season 'home and home' matches were instituted, and this custom has been observed ever since. By winning 12 of the first 16 matches played, Victoria established an early claim to supremacy; but, after a lengthy intermediate period of fluctuating equality, New South Wales by a remarkable run of victories in the last two decades or so has restored the balance, and transferred Victoria's original lead to her own credit. There has never been a drawn or unfinished match in the whole series. Up to the end of the 1924-5 season 108 matches have been played between New South Wales and Victoria, and of these New South Wales has won 59 and Victoria 49.

The continuity of the series was interrupted in 1863 through a dispute. In the Sydney match of February 1863 S. Jones, a local batsman, was given out stumped by G. Marshall after 'over' had been called by the umpire at the bowler's end. The Victorians left the field and would not return that day. Next day, with the umpires changed, they went on with the game, though Marshall and Greaves refused to play and returned to Melbourne. New South Wales won by 84 runs. The matter was referred to the M.C.C. in London, and the authorities at Lord's decided in favour of New South Wales. No matches were played until December 1865; but the Melbourne C. C. and the Albert C. C. played two matches during the interval, one in Melbourne and one in Adelaide. The other break in continuity was occasioned by the Great War, the suspension lasting from January 1915 to December 1918.

The first match between New South Wales and South Australia was played on the Sydney cricket-ground in February 1890, and resulted in a 9-wicket victory for New South Wales. Some distinguished cricketers took part in this match, the teams including S. P. Jones, A. C. Bannerman, H. Moses, W. L. Murdoch, S. E. Gregory, T. W. Garrett, H. Donnan, W. A. Richardson, S. Deane, J. J. Ferris, and P. C. Charlton for New South Wales, and J. J. Lyons, W. F. Giffen, G. Giffen, H. Le Haldane, H. Blinman, J. Tardiff, Ballans, J. Mackenzie, A. Hill, J. C. Reedman, and F. Jarvis for South Australia. In December of the same year a return match was played in Adelaide, New South Wales again proving victorious, this time by 6 wickets. The teams did not meet again until January 1892, when South Australia won the match at Sydney by an innings and 53 runs. So brilliantly did the South

Australians acquit themselves in this engagement —and in those with Victoria and Lord Sheffield's English eleven of that season—that it was decided to admit the colony into the intercolonial competition. Thus commenced in the season 1892-3 the triangular series of contests for cricket supremacy between New South Wales, Victoria, and South Australia known as the 'Sheffield Shield' contests. This shield was presented by Lord Sheffield—who in 1891 brought out a team captained by W. G. Grace—for the encouragement of Australian cricket; and the contests for it have ever since provided the principal Australian field of first-class cricket endeavour. Annual home-and-home engagements were fixed up, and South Australia, happy in the possession of such giants of the game as George Giffen (Australia's greatest all-rounder of his period in the eighties and nineties) and Jack Lyons (Australia's greatest hitter), actually won the premiership and the shield in the season of 1893-4. Not until 16 years later, however, did South Australia again win the shield; still, South Australian matches have always been highly interesting, if only because of the presence in her elevens of such men as Joe Darling, Ernest Jones, and Clem Hill. The importance of these triangular contests arises from the fact that until quite recently they constituted practically the whole of first-class cricket for the Australian season, and were the only avenues leading to the goal of every cricketer's ambition—inclusion in an Australian representative eleven. In that respect they may still be regarded as the chief trial games, since international selection depends almost entirely upon the form displayed and success achieved in these matches. Up to the end of the season 1924-5 the shield has been won three times by South Australia, ten times by Victoria and 16 times by New South Wales. Inclusive of the results in these and previous engagements with New South Wales, South Australia has, up to the end of the 1924-5 season, won 15 matches as against 44 by New South Wales. From January 1915 to December 1919 no matches were played between New South Wales and South Australia.

Victoria and South Australia first met at Adelaide in 1874, the South Australians taking the field with 18 men. Victoria won this match by 15 runs; but two years later, in a return engagement (also played at Adelaide), the tables were turned, South Australia winning by an innings and 70 runs. The teams met again on even terms (11 men a side) in 1880 at Melbourne, and victory went to Victoria by 7 wickets. In all, and including these contests up to the end of the 1924-5 season, 73 matches have been played between the two States, 49 of which have been won by Victoria and 24 by South Australia.

In Queensland cricket made slow headway for many years. Beginning in 1864 with a team of 22 against a New South Wales eleven, Queensland played ten matches with odds against the mother-colony before venturing on her first eleven-a-side match in 1893; of these ten each colony won four, and two were drawn. During recent years, however, Queensland has made great progress, and is advancing strong claims for inclusion in the Sheffield Shield competition. With New South Wales she has played on even terms 45 matches, winning eight; her record against Victoria is ten matches with one win.

From time to time matches have been played by teams from the eastern States against elevens of Western Australia, but up to the present the standard of play has not nearly reached the Sheffield Shield level. Geographically Western Australia has been at a great disadvantage, but since the completion of the transcontinental railway the way is open for a more frequent exchange of visits. It is only by these that the standard of play in the west can be materially improved. Against New South Wales six matches have been played for one victory, against Victoria seven for one.

Though Tasmanian cricket has a long and authentic history—probably the longest in Australia—the game has never reached the same high standard of enthusiasm, enterprise and skill as on the mainland. There is evidence, however, that a great deal of cricketing skill has been locked up in the little island for want of opportunity to develop. The first three intercolonial matches with Victoria in 1851, 1852, and 1854, have been already referred to; they were followed by an irregular series of games beginning in 1866, in which Tasmania was represented by 16 men; of these Victoria won the first, and Tasmania the second and third. From 1871 onwards the matches were played on level terms, though not against Victoria's best, alternately in Melbourne and Launceston or Hobart. Up to and including the 1923-4 season 38 matches have been played (including those in which Tasmania played with odds), Victoria having won 24 and Tasmania 13; one was drawn. Against New South Wales the first match was played at Sydney in 1897; there have been only six additional contests, one of which (that played in 1905 at Hobart) Tasmania won. Many fine individual performances stand to the credit of Tasmanian players in representative cricket—for example, C. J. Eady's 116 and 112 not out in the same match against Victoria in 1895; but nowadays the second elevens of both New South Wales and Victoria are regarded as quite strong enough to engage the best of Tasmania. Tasmanian cricket labours under certain natural disadvantages. Its insular position shuts it off from easy intercourse with the mainland, and from regular example of the best Australian cricketing models. Further, the scattered distribution of the population is a drawback financially, and blocks the promotion of internal sodality, which is of the utmost importance in the encouragement of educational visits to and from outside cricketing centres. Among the leading Tasmanian cricketers were George Bailey (who went to England in 1878 with the first Australian combination), T. Kendall (the left-hand bowler who played in a preliminary Australian tour with the 1878 Australian eleven), K. E. Burn (a member of the 1890 Australian team to England, and probably the best batsman Tasmania has produced), C. J. Eady (the giant all-rounder, a member of the 1896 Australian team in England, who once made the huge score of 566 in an innings that lasted 7 hours 55 minutes in a competition club match for Break-o'-Day against Wellington at Hobart in 1920), E. A. Windsor, an all-rounder, R. P. Hawson, a fine left-handed batsman, and E. A. McDonald, the fast bowler who migrated to Victoria and now resides in England.

The dominant feature of New Zealand cricket is its 'splendid isolation,' both in domestic and foreign relationships. The history of New Zealand cricket is largely the story of attempts to surmount geographical and climatic drawbacks. The game has never been lacking in enthusiasm; indeed New Zealand cricket history abounds with records of personal endeavour and

beneficence. The outstanding cricketer of the Dominion was Dan Reese (Canterbury), the only player in New Zealand representative cricket who made 2000 runs and took 150 wickets. Among leading batsmen A. B. Williams (Wellington) deserves special mention; the most famous bowlers were A. Downes and A. H. Fisher of Otago. Trials of strength with New South Wales and Victoria have been against second elevens of these States. The first contest with New South Wales took place in 1894, and only three games have been played since, one of which was won by New Zealand. Against Victoria three matches have been played; two were lost by New Zealand and one was drawn. On several occasions Australian teams have visited New Zealand, but the matches have been rather exhibitions than serious contests. Educative visits have also been made by English amateur teams, and in virtue of these periodical visits, and with the assistance of imported coaches, the standard of the game in the Dominion is steadily on the up-grade.

A match of the pre-district days which should not be forgotten was played in February 1867 by the Albert Club of Sydney against a team of aboriginals—by name Bullocky, Mullagh, Tiger, King Cole, Red Cap, Peter Jim Crow, Twopenny, Charlie, Cozens, Mosquito, Dick-a-Dick, and Tarpot, with a white man, Charlie Lawrence, as thirteenth man. The Alberts scored 298 runs and the aboriginals 164, and when the match ended early on the third day spectators were given a display of throwing the spear, boomerang, and cricket-ball. The team was afterwards taken to England, where it had some success.

International Cricket.—Though the domestic history of cricket in Australia is fairly lengthy, it is by international matches that it is best known to the world at large. The first 'All England' eleven was brought out in the season of 1861-2 by the well-known catering firm of Spiers and Pond; it consisted of H. H. Stephenson (Surrey, captain), G. Bennett (Kent), W. Caffyn (Surrey), G. Griffith (Surrey), T. Hearne (Middlesex), R. Iddison (Yorkshire), C. Lawrence (Kent), W. Mortlock (Surrey), W. Mudie (Surrey), T. Sewell (Surrey), E. Stephenson (Yorkshire), and G. Wells (Middlesex). It played 12 matches, all against odds, winning six, losing two, and drawing four. The first was played on 1 January 1862 at Melbourne, the English team meeting 18 of Victoria. England scored 305, and the eighteen 118 and 91. The first match against a combined Australian team —22 players selected from Victoria and New South Wales—was played at Melbourne on 17 and 18 January; it resulted in a draw, the twenty-two scoring 153 and 144 against 110 and 10 for no wickets by the All-England eleven. This match was followed by another against 22 New South Wales players at Sydney on 29 January; the Englishmen won by 49 runs, scoring 175 and 66 to 127 and 65. A trip to Hobart followed, during which Tasmania was defeated. Returning to Victoria, the Englishmen played a draw with a Victorian twenty-two, the captain of the latter team adhering to an agreement that the match was not to extend beyond four days. The Victorians had scored 140 and 151 and England 218 and 63 for 7 wickets. In the return match with the combined twenty-two they were beaten by 12 wickets. The members of the English team planted 12 elms, some of which still afford shelter at the Melbourne cricket-ground.

The warm welcome given to these players, and the local enthusiasm for the game, created a desire among English cricketers to revisit Australia, and in 1863-4 George Parr toured the colonies with a side that won against odds all its finished matches—the only team that has never been defeated in Australia. Six matches were drawn. The team included E. M. Grace, then one of the most brilliant batsmen in England. He figured in several single-wicket matches; on one occasion playing against six of Maryborough, he won the toss and stayed in all day for 106 runs.

Ten years elapsed before a third team visited Australia, this time under the captaincy of W. G. Grace, the greatest cricketer of any period. In the interim Australians had made great strides in the game. William Caffyn, who had come out with Stephenson's and Parr's teams, and Charles Lawrence, who had been one of Stephenson's team, were in 1864 engaged as coaches in Sydney. Caffyn was a brilliant batsman, the Trumper of his time. He went into business in Sydney as a hairdresser, and combined this with cricket-coaching on the Domain; in 1872 he returned to England, and died in 1919. Lawrence settled down in Australia. Caffyn and Lawrence both played for New South Wales in intercolonial matches. Their influence on the game was so important that when Grace's team came out in 1873-4 it was thrice defeated. Three years later James Lillywhite's team discovered a still more pronounced improvement; they played twelve matches against odds, and won four only, three being lost and five drawn. As a result New South Wales, having twice beaten them with odds, played against them the first eleven-a-side match in Australia against an English eleven. This was followed up by the first test match, which Australia won. Details of these historic contests are given below; it must be remembered that until 1887 in Australia and 1889 in England there were only 4 balls to the over.

LILLYWHITE'S TEAM V. NEW SOUTH WALES.

On the Albert Ground (now Prince Alfred Park), Sydney, 16 and 18 January 1877. Match drawn.

LILLYWHITE'S TEAM.

H. Charlwood, c Gregory, b Evans	18
A. Greenwood, b Evans	9
T. Armitage, c Thomson, b Evans	0
A. Shaw, b Spofforth	22
J. Selby, c Murdoch, b Garrett	32
T. Emmett, b Garrett	18
G. Ulyett, b Garrett	95
J. Lillywhite, st Thomson, b Evans	15
A. Hill, c C. Bannerman, b Evans	2
E. Pooley, b Garrett	37
J. Southerton, not out	16
Sundries	7
Total	271

	O.	M.	R.	W.
Spofforth	35	8	80	1
Evans	53	12	94	5
Garrett	38.3	12	69	4
Tindall	12	5	16	0
Thomson	3	3	0	0

NEW SOUTH WALES.

	First innings.	*Second innings.*
C. Bannerman, b Shaw	2	b Shaw 32
T. Powell, lbw, b Lillywhite	1	st Pooley, b Armitage 18
D. W. Gregory, c Southerton, b Shaw	3	not out 54
T. W. Garrett, b Shaw	6	b Shaw 0
F. R. Spofforth, b Lillywhite	5	lbw, b Shaw 7
N. Thomson, b Hill	19	not out 17
E. Evans, b Hill	30	b Hill 4
A. C. Bannerman, c Emmett, b Shaw	3	—
J. Dummett, b Hill	3	—
E. Tindall, b Shaw	1	—

W. L. Murdoch, not out				7	b Shaw				5
Sundries				2					3
Total				82	Total (6 w.)				140

	O.	M.	R.	W.	O.	M.	R.	W.
Shaw	53	34	19	5	43.2	23	35	4
Lillywhite	30	10	34	2	10	0	16	0
Hill	19	10	11	3	31	16	40	1
Armitage	3	0	16	0	6	1	11	0
Emmett	—	—	—	—	4	0	16	0
Ulyett	—	—	—	—	9	0	10	0

First Test Match between England and Australia.

On the Melbourne Cricket Ground, 15, 16, 17 and 19 March 1877. Australia won by 45 runs.

Australia.

First innings.		*Second innings.*	
C. Bannerman, retired hurt	165	b Ulyett	4
N. Thomson, b Hill	1	c Emmett, b Shaw	7
T. Horan, c Hill, b Shaw	12	c Selby, b Hill	20
D. W. Gregory (capt.), run out	1	b Shaw	3
B. B. Cooper, b Southerton	15	b Shaw	3
W. E. Midwinter, c Ulyett, b Southerton	5	c Southerton, b Ulyett	17
E. Gregory, c Greenwood, b Lillywhite	0	c Emmett, b Ulyett	11
J. M. Blackham, b Southerton	17	lbw, b Shaw	6
T. W. Garrett, not out	19	c Emmett, b Shaw	0
T. Kendall, c Southerton, b Shaw	3	not out	17
J. Hodges, b Shaw	0	b Lillywhite	8
B 4, lb 1, w 1, nb 1	7	B 5, lb 3	8
Total	245	Total	104

	O.	M.	R.	W.	O.	M.	R.	W.
Shaw	55.3	34	51	3	34	16	38	5
Hill	23	10	42	1	14	6	18	1
Ulyett	25	12	36	0	19	7	39	3
Southerton	37	17	61	3	—	—	—	—
Armitage	3.2	0	15	0	—	—	—	—
Lillywhite	14	5	19	1	1	0	1	1
Emmett	12	7	13	0	—	—	—	—

England.

First innings.		*Second innings.*	
H. Jupp, b Garrett	63	b Midwinter	4
J. Selby, c Cooper, b Hodges	7	c Horan, b Hodges	38
H. Charlwood, c Blackham, b Midwinter	36	b Kendall	13
G. Ulyett, b Thomson	10	b Kendall	24
L. Greenwood, c E. J. Gregory, b Midwinter	1	c Midwinter, b Kendall	5
T. Armitage, c Blackham, b Midwinter	9	c Blackham, b Kendall	3
A. Shaw, b Midwinter	10	st Blackham, b Kendall	2
T. Emmett, b Midwinter	8	b Kendall	9
A. Hill, not out	35	c Thomson, b Kendall	0
J. Lillywhite, c and b Kendall	10	b Hodges	4
J. Southerton, c Cooper, b Garrett	6	not out	1
Leg bye	1	B 4, lb 1	5
Total	196	Total	108

	O.	M.	R.	W.	O.	M.	R.	W.
Hodges	9	0	27	1	7	5	7	2
Garrett	18.1	10	22	2	2	0	9	0
Kendall	38	16	54	1	33.1	12	55	7
Midwinter	54	23	78	5	19	7	23	1
Thomson	17	10	14	1	—	—	—	—
D. Gregory	—	—	—	—	5	1	9	0

Umpires: Curtis Read and B. Terry.

The fifth team was brought to Australia by Lord Harris in 1878-9—a fine combination, mainly amateurs, with two Yorkshire professionals, T. Emmett and G. Ulyett. They played five matches on even terms, and were defeated three times. Alfred Shaw led the next team (1881-2), composed of professionals; it won three of the five finished matches. It was after that campaign that the 1882 Australian eleven defeated, at the Oval, the full strength of England. In 1882 Ivo Bligh set out after the 'ashes,' and his team won four of its seven matches. Then followed two professional teams, Alfred Shaw (1884-5) captaining the first and Arthur Shrewsbury (1886-7) the next. In 1887-8 rival teams visited Australia. C. A. Smith, a noted amateur, captained one which was organized with the patronage of the Sydney authorities; Melbourne invited a team under M. B. Hawke (afterwards Lord Hawke). Financial failure dogged both teams; for a few years English visits ceased, and Australian cricket, which had had five visiting teams in six years, was able to recover. Four years later, in 1891, Lord Sheffield laid Australia under a debt of gratitude by organizing at great expense a powerful team which, though captained by W. G. Grace, was beaten in two of the three tests. Lord Sheffield further stimulated Australian cricket by donating the shield already mentioned.

In 1894 the Sydney Cricket-ground Trust and the Melbourne C. C. joined forces and brought out the next team which, captained by A. E. Stoddart, won the rubber against Australia. In 1897-8 Stoddart's second team lost the 'ashes' after a memorable series of matches. K. S. Ranjitsinhji and A. C. MacLaren batted with wonderful success and brilliancy, and captivated the public to a greater degree than had any earlier English batsmen. It was under Stoddart, too, that Australia saw the two great fast bowlers, T. Richardson and W. H. Lockwood. Subsequent teams were captained by A. C. MacLaren (1901-2), P. F. Warner (1903-4), A. O. Jones (1907-8), P. F. Warner again (1911-12), J. W. H. T. Douglas (1920-1), and A. E. R. Gilligan (1924-5). Up to the end of the 1924-5 tour test matches in Australia produced for the English teams 24 wins, 36 defeats, and 2 draws.

Two English teams which were specially organized to play in New Zealand have also played matches in Australia. Lord Hawke's team (1902-3) under the captaincy of P. F. Warner lost two matches and drew one. A. C. MacLaren's (1922-3) lost three and drew three.

Australian teams in England.—The success of the Australian players against Lillywhite's team in 1876-7 inspired the cricketers of that period to form a team to invade England. The project did not enlist much practical support from the public, but the team played a number of matches in Australia and New Zealand before setting out, and then defrayed their own expenses to England. When they had defeated the M.C.C. at Lord's in one day—and in doing so had dismissed what was practically the full strength of England for 19 runs—and won other splendid victories the Australian people took up the team, and on its return gave it a national welcome. No 'test' match (in the technical sense) was played by this team; but the M.C.C. match took the place of one in the public mind.

The outstanding features of the play were the superb bowling of Spofforth and Boyle, the batting of C. Bannerman, the wicket-keeping of Blackham, and the leadership of D. W. Gregory.

1878 AUSTRALIAN ELEVEN v. M.C.C. AND GROUND.

At Lord's, 27 May 1878. Australian Eleven won by 9 wickets.

M.C.C. AND GROUND.

	First innings.	*Second innings.*
W. G. Grace, c Midwinter, b Allen	4	b Spofforth . 0
A. N. Hornby, b Spofforth	19	b Boyle . . 1
C. Booth, b Boyle	0	b Boyle . . 0
A. W. Ridley (capt.), c A. C. Bannerman, b Boyle	7	b Boyle . . 0
A. J. Webbe, b Spofforth	1	b Spofforth . 0
F. Wild, b Boyle	0	b Boyle . . 5
W. Flowers, c and b Spofforth	0	b Boyle . . 11
G. G. Hearne, b Spofforth	0	b Spofforth . 0
A. Shaw, st Murdoch, b Spofforth	0	not out . . 2
G. F. Vernon, st Murdoch, b Spofforth	0	b Spofforth . 0
F. Morley, not out	1	c Horan, b Boyle . . 0
Leg bye	1	—
Total	33	Total . . 19

	O.	M.	R.	W.	O.	M.	R.	W.
Allen	9	4	14	1	—	—	—	—
Boyle	14	7	14	3	8.1	6	3	6
Spofforth	5.3	3	4	6	9	2	16	4

AUSTRALIAN ELEVEN.

	First innings.	*Second innings.*
C. Bannerman, c Hearne, b Morley	0	b Shaw . . 1
W. Midwinter, c Wild, b Shaw	10	not out . . 4
T. Horan, c Grace, b Morley	4	not out . . 7
A. C. Bannerman, c Booth, b Morley	0	—
T. W. Garrett, c Ridley, b Morley	6	—
F. R. Spofforth, b Shaw	1	—
D. W. Gregory (capt.), b Shaw	0	—
H. F. Boyle, c Wild, b Morley	2	—
W. L. Murdoch, b Shaw	9	—
F. E. Allen, c and b Shaw	6	—
G. H. Bailey, not out	3	—
Total	41	Total (1 w.) 12

	O.	M.	R.	W.	O.	M.	R.	W.
Shaw	33.2	25	10	5	8	6	4	1
Morley	33	19	31	5	8	4	8	0

Umpires: Rylott and Sherwin.

When the second Australian eleven went to England in 1880, they were received coldly at headquarters, because of a riot that had taken place on the Sydney ground during the match between Lord Harris's 1878-9 team and New South Wales. However, Lord Harris eventually buried the hatchet, and the team played one test match with England at Kennington Oval; England scored 420, W. G. Grace making 152; Australia was all out for 149, but in the second innings scored 327, W. L. Murdoch going through for 153 not out. England lost five wickets in getting the 57 required to win, G. Palmer and H. F. Boyle bowling brilliantly. Unfortunately Australia was deprived of the services of Spofforth, who had been injured in a previous match.

The second team that Murdoch captained (1882) vanquished the full strength of England at Kennington Oval in what was styled the greatest match ever played up to that time. It was the only test match of the tour.

In *Surrey Cricket: Its History and Associations* by Lord Alverstone and C. W. Alcock, the secretary of the Surrey County C. C. thus pictured the finish of this remarkable match:—

The crowning feature of the tour for the Australians was their historic victory over England at the Oval. It was a bowler's wicket from the start, and the English side were able, though they scored only 101, to head their opponents by 38 runs. H. H. Massie's brilliant hitting stood the Australians in good stead when they began their second innings. Taking full advantage of the chance before the wicket had got very difficult again, he scored 55 out of a total of 122. With only 85 to get to win England seemed to have the victory assured. With 51 up for only two wickets, and W. G. Grace and Ulyett well in, the result was apparently a certainty. Thirty-four still to win and seven good wickets to fall! Then, after a hit for 2, W. G. was easily taken at mid-off, having made 32—an invaluable score. The Hon. Alfred Lyttelton and A. P. Lucas were now together, and with twelve maiden overs in succession and two batsmen both able to hit if they liked, the spectators began to realize that the issue was by no means certain. The tension grew acute as it was seen how difficult it was to get the ball away. Spofforth and Boyle were keeping an irreproachable length. Blackham, without anyone behind him, and Spofforth bowling his hardest, was as steady as the old guard at the wicket. It was wonderful all-round cricket. The excitement was intense as the agony was prolonged, and one could almost hear one's own heart beat. It was a terribly anxious time, and no wonder. Some of the younger batsmen on the English side still to come in were nervous. When Lyttelton was bowled 19 runs were wanted with half the wickets still in hand, and with 9 added two more batsmen went. With only 10 to get three hits would have settled the matter. Murdoch has since said that his only fear at the crisis was that some one would have a go at Boyle. This bowler was keeping a wonderful length, and to hit him would have been risky, of course. But there was no attempt to hit, and Boyle, dismissing the last two batsmen, gave the Australians their first victory over England in England by 7 runs. It was a glorious finish, and the Australians thoroughly deserved their honours.

AUSTRALIA v. ENGLAND.

At Kennington Oval, 28 and 29 August 1882.

AUSTRALIA.

	First innings.	*Second innings.*
A. C. Bannerman, c Grace, b Peate	9	c Studd, b Barnes . 13
H. H. Massie, b Ulyett	1	b Steel . . . 55
W. L. Murdoch, b Peate	13	run out . . 29
G. J. Bonnor, b Barlow	1	b Ulyett . 2
T. Horan, b Barlow	3	c Grace, b Peate . . 2
G. Giffen, b Peate	2	c Grace, b Peate . . 0
J. M. Blackham, c Grace, b Barlow	17	c Lyttelton, b Peate . 7
T. W. Garrett, c Read, b Peate	10	not out . . 2
H. F. Boyle, b Barlow	2	b Steel . . 0
S. P. Jones, c Barnes, b Barlow	0	run out . . 6
F. R. Spofforth, not out	4	b Peate . . 0
Bye	1	Byes . . 6
Total	63	Total . .122

	O.	M.	R.	W.	O.	M.	R.	W.
Peate	38	24	31	4	21	9	40	4
Ulyett	9	5	11	1	6	2	10	1
Barlow	31	22	19	5	13	5	27	0
Steel	2	1	1	0	7	0	15	2
Barnes	—	—	—	—	11	5	15	1
Studd	—	—	—	—	4	1	9	0

ENGLAND.

	First innings.	*Second innings.*
R. G. Barlow, c Bannerman, b Spofforth	11	b Spofforth . 0
W. G. Grace, b Spofforth	4	c Bannerman, b Boyle . 32
G. Ulyett, st Blackham, b Spofforth	26	c Blackham, b Spofforth 11
A. P. Lucas, c Blackham, b Boyle	9	b Spofforth . 5
A. Lyttelton, c Blackham, b Spofforth	2	b Spofforth . 12
C. T. Studd, b Spofforth	0	not out . . 0
J. M. Read, not out	19	b Spofforth . 0

W. Barnes, b Boyle . . .	5				c Murdoch, b Boyle .	2			
A. G. Steel, b Garrett . .	14				c and b Spofforth . .	0			
A. N. Hornby, b Spofforth	2				b Spofforth .	9			
E. Peate, c Boyle, b Spofforth	0				b Boyle . .	2			
B 6, lb 2, nb 1	9				B 3, nb 1	4			
Total	101				Total . .	77			
	O.	M.	R.	W.		O.	M.	R.	W.
Spofforth . . .	36.3	18	46	7		28	15	44	7
Garrett	16	7	22	1		7	2	10	0
Boyle	19	7	24	2		20	11	18	3

Umpires: R. Thom and L. Greenwood.

The 1884 Australian eleven, the third captained by W. L. Murdoch, was also a fine all-round combination. Three test matches were played, the first and last being drawn in favour of Australia, but England won the Lord's match by an innings and five runs. It was in the third match, at Kennington Oval, that Australia scored 551 runs, W. L. Murdoch making 211, P. S. McDonnell 103, and H. J. H. Scott 104.

The next four Australian teams showed a falling off in standard, and many defeats were inflicted on them. The 1888, 1890 and 1893 teams lost 40 matches and won only 49, and the 1886 team won only nine matches out of 16. But every team since—save that captained by S. E. Gregory in 1912, which many of the more notable players declined to join (partly owing to a difference with the board of control)—has proved a great combination; and it has long been realized that the pupil has become as proficient as the master. Of test matches played in England the home teams have won 17, the Australians 11, and 19 have been drawn.

AUSTRALIAN TEAMS IN ENGLAND.

Team.	Captain.	Eleven-a-side.			Odds matches.		
		W.	L.	D.*	W.	L.	D.*
1878	D. W. Gregory .	9	4	4	9	3	8
1880	W. L. Murdoch .	5	2	4	16	2	8
1882	W. L. Murdoch .	23	4	11	—	—	—
1884	W. L. Murdoch .	18	7	7	—	—	—
1886	H. J. H. Scott .	9	7	22	0	1	0
1888	P. S. McDonnell	19	14	7	—	—	—
1890	W. L. Murdoch .	13	16	9	—	—	—
1893	J. M. Blackham	17	10	8	1	0	0
1896	G. H. S. Trott .	19	6	9	—	—	—
1899	J. Darling . .	16	3	16	—	—	—
1902	J. Darling . .	23	2	14	—	—	—
1905	J. Darling . .	16	3	18	0	0	1
1909	M. A. Noble .	13	4	22	—	—	—
1912	S. E. Gregory .	9	8	20	—	—	—
1921	W. Armstrong .	23	2	14	—	—	—

*Won, Lost, Drawn.

The A.I.F. team in 1919 played 32 matches in England, winning 13, losing 4, and drawing 15.

PERSONNEL OF AUSTRALIAN TEAMS IN ENGLAND.

First (1878).—D. W. Gregory (captain), F. E. Allen, G. H. Bailey, C. Bannerman, A. C. Bannerman, T. Horan, W. E. Midwinter, T. W. Garrett, J. M. Blackham, F. R. Spofforth, H. F. Boyle, W. L. Murdoch, with John Conway, manager.

Second (1880).—W. L. Murdoch (captain), J. M. Blackham, F. R. Spofforth, A. C. Bannerman, H. F. Boyle, G. J. Bonnor, G. E. Palmer, P. S. McDonnell, G. Alexander (player and manager), A. H. Jarvis, T. U. Groube, W. H. Moule, and J. Slight.

Third (1882).—W. L. Murdoch (captain), T. Horan, T. W. Garrett, J. M. Blackham, F. R. Spofforth, A. C. Bannerman, H. F. Boyle, G. J. Bonnor, G. E. Palmer, P. S. McDonnell, G. Giffen, S. P. Jones, H. H. Massie, with C. W. Beal, manager.

Fourth (1884).—W. L. Murdoch (captain), W. E. Midwinter, J. M. Blackham, F. R. Spofforth, A. C. Bannerman, H. F. Boyle, G. J. Bonnor, G. E. Palmer, P. S. McDonnell, G. Giffen, H. J. H. Scott, W. H. Cooper, with G. Alexander, manager.

Fifth (1886).—H. J. H. Scott (captain), T. W. Garrett, J. M. Blackham, F. R. Spofforth, G. J. Bonnor, G. E. Palmer, A. H. Jarvis, G. Giffen, S. P. Jones, W. Bruce, E. Evans, J. McIlwraith, J. W. Trumble, with Major B. J. Wardill, manager.

Sixth (1888).—P. S. McDonnell (captain), G. J. Bonnor, G. H. S. Trott, A. C. Bannerman, S. P. Jones, C. T. B. Turner, J. J. Lyons, J. D. Edwards, A. H. Jarvis, J. J. Ferris, J. Worrall, J. M. Blackham, H. F. Boyle, with C. W. Beal, manager. S. M. J. Woods, a Sydney man at Cambridge University, played six matches with this team.

Seventh (1890).—W. L. Murdoch (captain), J. J. Lyons, G. H. S. Trott, J. M. Blackham, F. H. Walters, S. P. Jones, C. T. B. Turner, J. E. Barrett, J. J. Ferris, S. E. Gregory, P. C. Charlton, K. E. Burn, H. Trumble, with H. F. Boyle, manager.

Eighth (1893).—J. M. Blackham (captain), J. J. Lyons, H. Graham, A. C. Bannerman, W. Bruce, S. E. Gregory, G. H. S. Trott, A. Coningham, H. Trumble, R. W. McLeod, G. Giffen, C. T. B. Turner, W. F. Giffen, A. H. Jarvis, with Victor Cohen, manager.

Ninth (1896).—G. H. S. Trott (captain), S. E. Gregory, J. Darling, C. Hill, F. A. Iredale, G. Giffen, H. Donnan, H. Trumble, H. Graham, J. J. Kelly, A. E. Johns, C. J. Eady, E. Jones, T. R. McKibbin, with H. Musgrove, manager.

Tenth (1899).—J. Darling (captain), C. Hill, M. A. Noble, J. Worrall, V. Trumper, F. Laver, F. A. Iredale, H. Trumble, S. E. Gregory, J. J. Kelly, E. Jones, C. E. McLeod, W. P. Howell, A. E. Johns, with Major B. J. Wardill, manager.

Eleventh (1902).—J. Darling (captain), V. Trumper, M. A. Noble, C. Hill, R. A. Duff, W. W. Armstrong, A. J. Hopkins, S. E. Gregory, H. Trumble, J. J. Kelly, E. Jones, H. Carter, W. P. Howell, J. V. Saunders, with Major J. B. Wardill, manager.

Twelfth (1905).—J. Darling (captain), M. A. Noble, V. Trumper, W. W. Armstrong, C. Hill, A. J. Hopkins, R. A. Duff, S. E. Gregory, D. R. A. Gehrs, C. E. McLeod, J. J. Kelly, A. Cotter, F. Laver (player and manager), P. M. Newland, and W. P. Howell.

Thirteenth (1909).—M. A. Noble (captain), V. Trumper, S. E. Gregory, W. Bardsley, W. W. Armstrong, V. S. Ransford, P. A. McAlister, C. G. Macartney, R. J. Hartigan, H. Carter, A. J. Hopkins, J. A. O'Connor, A. Cotter, W. Carkeek, W. J. Whitty, with F. Laver, player and manager.

Fourteenth (1912).—S. E. Gregory (captain), W. Bardsley, C. G. Macartney, C. Kelleway, C. B. Jennings, E. R. Mayne, R. B. Minnett, J. T. Matthews, H. Webster, S. H. Emery, D. Smith, W. J. Whitty, W. Carkeek, J. W. McLaren, G. R. Hazlitt, with G. S. Crouch as manager for the board of control.

Fifteenth (1921).—W. W. Armstrong (captain), H. L. Collins, W. Bardsley, C. G. Macartney, H. Carter, J. M. Taylor, J. M. Gregory, W. A. Oldfield, E. A. McDonald, T. J. Andrews, H. L. Hendrey, J. S. Ryder, A. Mailey, C. E. Pellew, and E. R. Mayne, with Sydney Smith, jr., as manager for the board of control.

ENGLISH TEAMS IN AUSTRALIA.

Team.	Captain.	Eleven-a-side.			Odds matches.		
		W.	L.	D.	W.	L.	D.
1861-2	H. H. Stephenson .	—	—	—	6	2	4
1863-4	G. Parr	—	—	—	10	0	6
1873-4	W. G. Grace	—	—	—	10	3	2
1876-7	J. Lillywhite . . .	1	1	1	10	3	7
1878-9	Lord Harris	2	3	0	4	0	4
1881-2	A. Shaw	3	2	2	10	1	7
1882-3	Ivo Bligh	4	3	0	5	0	5
1884-5	A. Shaw	6	2	0	10	0	15
1886-7	A. Shrewsbury . .	6	2	2	6	0	13
1887-8	C. A. Smith . . .	5	2	0	9	0	9
1887-8	M. B. Hawke . . .	6	1	1	5	0	13
1891-2	W. G. Grace . . .	6	2	0	6	0	13
1894-5	A. E. Stoddart . . .	8	4	0	1	0	10
1897-8	A. E. Stoddart . . .	4	5	3	2	0	8
1901-2	A. C. MacLaren . .	5	6	0	3	0	8

		Eleven-a-side.			Odds matches.		
		W.	L.	D.	W.	L.	D.
1903-4	P. F. Warner . . .	9	2	3	1	0	5
1907-8	A. O. Jones . . .	7	4	7	0	0	1
1911-2	P. F. Warner . . .	12	1	2	0	0	3
1920-1	J. W. H. T. Douglas	6	6	3	3	0	4
1924-5	A. E. R. Gilligan .	7	6	4	1	0	5

In 1887-8 the two English teams combined and played a match at Sydney against Australia, which they won by 126 runs.

PERSONNEL OF ENGLISH TEAMS IN AUSTRALIA.

1861-2.—H. H. Stephenson (captain), G. Bennett, W. Caffyn, G. Griffith, T. Hearne, R. Iddison, C. Lawrence, W. Mortlock, W. Mudie, T. Sewell, E. Stephenson, and G. Wells.

1863-4.—George Parr (captain), G. Anderson, W. Caffyn, A. Clarke, J. Jackson, G. Tarrant, E. M. Grace, Julius Caesar, R. Carpenter, T. Hayward (Cambridgeshire), T. Lockyer, and R. C. Tinley.

1873-4.—W. G. Grace (captain), J. A. Bush, G. F. Grace, R. Humphrey, James Lillywhite, W. Oscroft, F. H. Boult, W. R. Gilbert, A. Greenwood, H. Jupp, M. McIntyre, and J. Southerton.

1876-7.—James Lillywhite (captain), H. Charlwood, A. Greenwood, H. Jupp, J. Selby, J. Southerton, T. Armitage, T. Emmett, A. Hill, E. Pooley, A. Shaw, and G. Ulyett.

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The name 'alligator,' often applied to Australian crocodiles, is quite incorrect. True alligators are only to be found in the southern States of North America, and in China. In our crocodiles the fourth tooth on each side of the lower jaw is much enlarged, and fits into a notch in the upper jaw, being thus plainly visible when the mouth is closed. In alligators a similar tooth fits into a pit within the border of the upper jaw; the typical alligator, moreover, has a more rounded head, and is more sluggish than the voracious crocodile with its pointed snout.

Crocodiles are oviparous. In the coastal species the number of eggs varies from 20 to 80; they are white, varying considerably in dimensions, the average being about the size of those of a duck, but more elongated. J. MacGillivray gives the following description of a nest on the banks of the Claudie River, at Lloyd's Bay in northern Queensland:—'A crocodile's nest was noted on the right bank, in the mangrove portion, and we landed to examine it. The mangroves were small, the bank about 18 inches above high-tide mark, and the nest 8 feet in from the water's edge. It had a base diameter of about 4½ feet, and 2 feet across the top; it was 3 feet high, composed of decaying vegetation and sand. Uncovering it, the eggs, 43 in number, were found within a foot of the top, all in a heap. A piece of stick was laid across the middle of the eggs —whether by accident or design it is hard to say; but the blacks aver that it is always so.' Newly-hatched specimens are very lively at times, and snap in a vicious manner. They are about ten inches in length. Up to the present, little or no economic use has been made of the skins of either of our Australian crocodiles. H.A.L.

Crook. WILLIAM PASCOE (1775-1846), born at Dartmouth in Devon on 29 April 1775, and during his youth employed in domestic service and tin-working, was accepted by the London Missionary Society (then known as 'The Missionary Society') and sent with a mission party destined for Tahiti, Tonga, and the Marquesas group, leaving England on 10 August 1796. Despite the hostility of the natives, which drove his companions to Australia, Crook worked on in the Marquesas until in 1799 he was recalled to England. Still desiring a missionary career, he was in April 1803 despatched by the Society (which the then colonial secretary, Lord Hobart, seems to have confused with the Society for the Propagation of the Gospel) to take up mission work in the projected settlement under Collins at Port Phillip; that being abandoned, he came on in November to Port Jackson, and was employed as a teacher in the school at Parramatta, with liberty to preach once a fortnight at Ryde and Castle Hill. King next sent him as storekeeper for Paterson's abortive attempt to settle on the Tamar, but cancelled the appointment when the expedition proved a failure, and allowed him to resume his teaching, so that he was able to open a day and boarding-school at Parramatta. During the rule of Bligh's opponents he was employed by them in lieu of Henry Fulton to conduct divine service and baptize; he therefore moved to Sydney, and opened a school at the corner of Hunter- and Bligh-streets—the first boarding-school in Sydney. Reverting to private life on Macquarie's arrival, he on 27 August 1810 joined other missionaries who had been driven from the islands in founding a Congregational Church for Australia, and at once was rebuked by Macquarie at Marsden's instigation for administering the Lord's Supper while an unlicensed and unordained clergyman. At the end of 1815 Crook (on Marsden's recommendation) was appointed by the London Missionary Society to Moorea (and later t Tahiti) in the Society Islands, where he did missionary and medical work for 15 years; on his return to

		Eleven-a-side.			Odds matches.		
		W.	L.	D.	W.	L.	D.
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1907-8	A. O. Jones . . .	7	4	7	0	0	1
1911-2	P. F. Warner . . .	12	1	2	0	0	3
1920-1	J. W. H. T. Douglas	6	6	3	3	0	4
1924-5	A. E. R. Gilligan .	7	6	4	1	0	5

In 1887-8 the two English teams combined and played a match at Sydney against Australia, which they won by 126 runs.

PERSONNEL OF ENGLISH TEAMS IN AUSTRALIA.

1861-2.—H. H. Stephenson (captain), G. Bennett, W. Caffyn, G. Griffith, T. Hearne, R. Iddison, C. Lawrence, W. Mortlock, W. Mudie, T. Sewell, E. Stephenson, and G. Wells.

1863-4.—George Parr (captain), G. Anderson, W. Caffyn, A. Clarke, J. Jackson, G. Tarrant, E. M. Grace, Julius Caesar, R. Carpenter, T. Hayward (Cambridgeshire), T. Lockyer, and R. C. Tinley.

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The name 'alligator,' often applied to Australian crocodiles, is quite incorrect. True alligators are only to be found in the southern States of North America, and in China. In our crocodiles the fourth tooth on each side of the lower jaw is much enlarged, and fits into a notch in the upper jaw, being thus plainly visible when the mouth is closed. In alligators a similar tooth fits into a pit within the border of the upper jaw; the typical alligator, moreover, has a more rounded head, and is more sluggish than the voracious crocodile with its pointed snout.

Crocodiles are oviparous. In the coastal species the number of eggs varies from 20 to 80; they are white, varying considerably in dimensions, the average being about the size of those of a duck, but more elongated. J. MacGillivray gives the following description of a nest on the banks of the Claudie River, at Lloyd's Bay in northern Queensland:—'A crocodile's nest was noted on the right bank, in the mangrove portion, and we landed to examine it. The mangroves were small, the bank about 18 inches above high-tide mark, and the nest 8 feet in from the water's edge. It had a base diameter of about 4½ feet, and 2 feet across the top; it was 3 feet high, composed of decaying vegetation and sand. Uncovering it, the eggs, 43 in number, were found within a foot of the top, all in a heap. A piece of stick was laid across the middle of the eggs —whether by accident or design it is hard to say; but the blacks aver that it is always so.' Newly-hatched specimens are very lively at times, and snap in a vicious manner. They are about ten inches in length. Up to the present, little or no economic use has been made of the skins of either of our Australian crocodiles. H.A.L.

Crook. WILLIAM PASCOE (1775-1846), born at Dartmouth in Devon on 29 April 1775, and during his youth employed in domestic service and tin-working, was accepted by the London Missionary Society (then known as 'The Missionary Society') and sent with a mission party destined for Tahiti, Tonga, and the Marquesas group, leaving England on 10 August 1796. Despite the hostility of the natives, which drove his companions to Australia, Crook worked on in the Marquesas until in 1799 he was recalled to England. Still desiring a missionary career, he was in April 1803 despatched by the Society (which the then colonial secretary, Lord Hobart, seems to have confused with the Society for the Propagation of the Gospel) to take up mission work in the projected settlement under Collins at Port Phillip; that being abandoned, he came on in November to Port Jackson, and was employed as a teacher in the school at Parramatta, with liberty to preach once a fortnight at Ryde and Castle Hill. King next sent him as storekeeper for Paterson's abortive attempt to settle on the Tamar, but cancelled the appointment when the expedition proved a failure, and allowed him to resume his teaching, so that he was able to open a day and boarding-school at Parramatta. During the rule of Bligh's opponents he was employed by them in lieu of Henry Fulton to conduct divine service and baptize; he therefore moved to Sydney, and opened a school at the corner of Hunter- and Bligh-streets—the first boarding-school in Sydney. Reverting to private life on Macquarie's arrival, he on 27 August 1810 joined other missionaries who had been driven from the islands in founding a Congregational Church for Australia, and at once was rebuked by Macquarie at Marsden's instigation for administering the Lord's Supper while an unlicensed and unordained clergyman. At the end of 1815 Crook (on Marsden's recommendation) was appointed by the London Missionary Society to Moorea (and later t Tahiti) in the Society Islands, where he did missionary and medical work for 15 years; on his return to

Sydney (at the end of 1830) he resumed both his teaching and his pastoral work, and after a while built a little church at Watson's Bay. By the time this was finished, however, in 1841, Crook's health had given way; he was forced to leave Sydney and reside with his son in Melbourne, and died there on 14 June 1846.

Crook's controversy with Marsden is of some importance, and must be elucidated. In 1796 the young missionaries, Crook among them, had been solemnly set apart for the work, and he and his colleagues seem to have regarded this as a form of ordination; it is not at all certain that the Society took this view. When in 1810 Crook and four others organized the first Congregational Church in Australia, it was decided to administer the Lord's Supper, and Crook was chosen to preside. He was already out of favour with the authorities for having during the Bligh mutiny acted as chaplain and performed functions only permissible to a priest; Marsden therefore took the opportunity of attacking him for having administered the sacred rite without ordination. As Marsden claimed to be the colonial representative of the London Missionary Society, he was in a strong position as regarded Crook, and Macquarie was bound to support him—the more so because the governor was already attempting to bind Marsden himself down to a stricter observance of Anglican rites. F.V.P.

Crotalaria, a large genus of the family Leguminosae, consisting of herbs or shrubs, widely distributed over tropical regions. The flowers are yellow or blue, in terminal sprays; pod swollen; leaves entire or divided into 3 leaflets. Several species are suspected of causing disease in stock that eat their legumes. This disease is known as 'nenta' in South Africa, and 'loco-disease' in the western United States; it is similar to, if not identical with, the Australian 'pea-eating disease.' *C. juncea,* a northern Australian species, is an erect annual with large yellow flowers. It extends to India, where it is known as 'Sunn hemp,' and is cultivated for the valuable fibre yielded by its inner bark.

Croton, a large, mainly tropical genus of the family Euphorbiaceae, consisting of trees, shrubs, and herbs, usually clothed with star-like hairs. Eleven indigenous species extend through New South Wales to Queensland and northern Australia. The flowers are usually dull; fruit a capsule. *C. Verreauxii* (Native Cascarilla) is a small tree with drooping flower-spikes, the flowers fringed with long woolly hairs. It has a yellowish close-grained timber. *C. phebalioides* is a tree of 40-50 feet, with pendulous branches which, together with the under-sides of the leaves, have a silvery coating of scales. The bark contains an agreeable aromatic bitter; the timber is close-grained and tough, but liable to warp and split in seasoning. *C. insularis* (Queensland Cascarilla, the 'warrel' of the aborigines) has a tough yellow wood, and yields a dye.

Crowfoot. See BUTTERCUP and GERANIUM.

Crows, perching birds of rather large size and black plumage, belonging to the genus *Corvus* and family Corvidae. To the systematic ornithologist the Australian crows are still a puzzle; though all authors agree that three distinct species are found in the continent, no two agree as to the distinguishing features, or as to the range enjoyed by each of the two larger forms. In spite of this, most authors distinguish one of them as the Australian raven, and have placed it in a different genus (*Corone*). The third species, the Small-billed Crow (*Corvus bennetti*), may be at once distinguished by its smaller size. It is an inhabitant of the inland districts of southern and western Australia, and in habits does not appear to differ from its larger relatives. The supposed distinctions between the Crow (*C. cecilae*) and the Raven (*C. coronoides*) are that the former has black body-feathers, snow-white at the base, and hazel eyes; the latter has body-feathers black throughout or dusky at the base, eyes white in the adult though hazel in the young, and some of the throat-feathers elongate and pointed. The latter appears to have a more southerly range than the former, and to be the only species found in Tasmania. All are known to bushmen merely as crows.

They are wary birds, uttering a melancholy, harsh caw which, though one of the characteristic sounds of the bush, seems rather to intensify than to break, its solitude. Crows are more or less sociable, assembling in small scattered companies, or in large numbers when a dead carcase, or a field of newly sown corn, offers them an ample repast. Insects, however, are their staple food, and they devour quantities of grasshoppers, beetles, and caterpillars. They are also partial to fruit, and sometimes make raids on orchards; but their worst sin is that of plucking out the eyes of sick sheep and lambs (some authorities consider that the raven alone is guilty of this last crime). Being thus omnivorous, it becomes a difficult matter to balance the evil they do against their undoubtedly beneficial activities, so as to decide whether their destruction is or is not desirable. Few men on the land give them the benefit of the doubt; but their intelligence, or instinctive cunning, makes their destruction no easy matter, and they are still universally distributed. Owing to the prevalence of the blow-fly pest on sheep in recent years, the value of their scavenging work in removing possible breeding-places for the fly—as well as their wholesale destruction of fly-maggots—has gained much greater recognition, and on many sheep-stations they now enjoy protection. On the other hand they have become very fond of the fruit of the prickly pear (q.v.), and are an important agent in introducing the seed to new districts; hence in prickly-pear areas their destruction is strongly advocated. Crows build large nests of sticks in the tops of trees, and lay three or four dull green eggs, blotched and spotted with brown. W.B.A.

Crowther, WILLIAM LODEWYK (1817-1885), born at Haarlem in Holland on 15 April 1817 and brought by his parents to Tasmania in 1824, was educated at Longford and trained for the medical profession by his father, who was a surgeon. During his boyhood he diligently collected Tasmanian animals—both live specimens and skins—and in 1839 took his collections to England, sold them (the live animals to the Zoological Society), and with the proceeds maintained himself while attending St. Thomas's hospital for medical training (M.D., 1841; F.R.C.S., 1874). In 1842 he returned to Tasmania and took over his father's practice in Hobart. From 1850 to 1870 he interested himself in the whaling industry, and owned a small fleet of whalers which added much to the prosperity of the port. In 1866 he was elected by Hobart to the legislative assembly, but resigned after two months' attendance; in March 1869 the Hobart division elected him to the legislative council, and he retained the seat to the day of his death. From July 1876 to August 1877

he was a member of the Reibey ministry, and from December 1878 to October 1879 was himself premier, but on neither occasion administered a department. He died at Hobart on 12 April 1885.

Crustacea, a large and important class of animals comprising crabs, lobsters, crayfishes, prawns, shrimps, sandhoppers, barnacles, water-fleas, and woodlice. The orders particularly discussed in these volumes belong to the sub-classes Entomostraca (see WATER-FLEAS) and Malacostraca: in the latter sub-class are included Isopoda (see WOODLICE), Amphipoda (see SANDHOPPERS), and Decapoda, the last order being again divided into Macrura (see PRAWNS AND SHRIMPS and CRAYFISHES), Anomura (see HERMIT CRABS), and Brachyura (see CRABS). Other crustacean orders either do not occur in Australia or have no specially Australian forms.

Cryptocarya, a genus of the family Lauraceae, consisting of trees or tall shrubs, chiefly Asiatic, with a few species found in South Africa and South America. Sixteen species are indigenous to eastern Australia. *C. obovata* is one of several trees known as 'she-beech,' a tree up to 100 feet, extending from New South Wales into Queensland, having aromatic leaves and yielding useful timber. *C. glaucescens* (Brown Beech, Black Sassafras), is a tree of 40 feet confined to coastal New South Wales and Queensland. *C. microneura* (Murrogun), also found in the coastal brushes, has a hard, close-grained wood, fragrantly aromatic. *C. australis* (Grey Sassafras, Moreton Bay Laurel), has a light, useful timber with an odour objectionable to insects. The bark has a bitter taste, due to the presence of an alkaloid.

Cuckoos, birds with long tails, and feet with two toes before and two behind (as in parrots), belonging to the order Cuculiformes. Birds of this order are found throughout the world, but are specially numerous in the Australian region. Fourteen species, belonging to four families, are found in Australia and Tasmania, 11 of which are true cuckoos (family Cuculidae). All those found in southern Australia and Tasmania are summer migrants, but in northern Australia some species are to be found at all seasons. Australian cuckoos, like the well-known European cuckoo, deposit their eggs in the nests of smaller birds, usually extracting an egg from the nest in which their own egg is placed. As a rule each species of cuckoo is parasitic on a small number of other species of birds, to the eggs of which its own bear a fairly close resemblance. For example, the eggs of the Pallid Cuckoo (*Cuculus pallidus*), which are pale buffish-pink, are generally placed in nests of the larger honey-eaters—such as wattle-birds and miners—which lay eggs of a similar colour. They are, however, not uncommonly found in the nests of other birds—e.g. wagtails or reed-warblers—to the eggs of which they bear no resemblance. In such cases it is almost certain that the cuckoo has been unable to find a honey-eater's nest at the right stage to receive her egg.

The young cuckoo, soon after hatching and before its eyes are open, manages to get the eggs or young of the rightful owner of the nest one after another on to its back. Each is then carried up to the edge and thrown out; thereafter the young cuckoo (which has a voracious appetite) receives all the attention of its foster-parents. These continue to feed it after it leaves the nest, when it is much larger than themselves; sometimes it also receives food from birds other than its foster-parents.

Almost all cuckoos utter loud and constantly repeated calls or shrill whistles, which in the breeding-season are to be heard all day and frequently at night as well, so that their constant repetition becomes exceedingly wearisome. The pallid cuckoo is the commonest species throughout southern Australia, its call consisting of a succession of notes in an ascending scale, the last being repeated several times. The Fan-tailed Cuckoo (*Cacomantis flabelliformis*), a rather smaller species, also common, utters a plaintive, trilling note. The four other comparatively large cuckoos are rarer, and are chiefly found in the north.

The five small bronze cuckoos resemble one another very much in appearance, but their notes are quite distinctive. The common Bronze Cuckoo (*Lamprococcyx plagosus*) and three of

Bronze Cuckoo.

its allies are exceptions to the rule about eggs already mentioned; they lay olive-brown eggs, and generally place them in the nests of tits or wrens which lay white eggs, more or less speckled. The nests of these birds being domed, the eggs are almost in darkness, and coloration is probably of less importance. Numerous instances are on record, however, of birds deserting their nests when a bronze cuckoo's egg has been placed in it; and sometimes the birds add to the lining of their nests, so that the cuckoo's egg is covered over. The Narrow-billed Bronze Cuckoo (*Chalcites basalis*), though almost indistinguishable from its relatives in plumage, chooses open nests in which to lay its white, speckled eggs.

Cuckoos play an important economic role, since their favourite diet is hairy caterpillars, which few other birds will touch. We must set against this, however, the destruction of many other insectivorous birds that results from their parasitic habits.

The Australian Koel or Coo-ee-bird (*Eudynamis orientalis*), our sole representative of the koel family (Eudynamidae), is common during

the summer in northern and eastern Australia. Its call is loud and mellow, not unlike a coo-ee; it has even been suggested that the aboriginal cry is an imitation of this bird's note. In the koel the sexes are quite distinct in colouring, the male being glossy black and the female brown, spotted with white. The egg is usually placed in the nest of a friar-bird, miner, or oriole.

The remarkable Channelbill (*Scythrops novae-*

Channelbill.

hollandiae), the sole member of its genus and of the family Scythropidae, visits northern Australia in the summer from the Malay Archipelago. It is a large grey bird, with a bill resembling that of a toucan and a patch of bare red skin surrounding the eye. Its note is a loud scream, and it is often called rainbird, as it is supposed to be specially noisy before rain. It places its eggs in the nests of crows or magpies.

The Coucal or Swamp Pheasant (*Centropus*

Swamp Pheasant.

phasianinus) is the only Australian representative of the family Centropodidae, members of which occur throughout the warmer parts of the old world. The coucal is found throughout northern Australia wherever there are swamps with plenty of tussocky grasses. The name 'swamp pheasant' by which it is commonly known, is due to its strong resemblance to a hen pheasant; but the structure of the feet at once indicates its real affinities. The coucal is the only Australian cuckoo which makes a nest and rears its own young. The nest is a large, domed structure in a grass tussock, with a hole at each side; the head and tail of the bird project from these holes when it is sitting; the eggs, 3 to 5 in number, are dirty white. The swamp pheasant runs rapidly on the ground, and frequently clambers into a bush or low tree, whence it utters a deep note, constantly repeated, resembling the croak of a frog. W.B.A.

Cuckoo-shrikes and Caterpillar-eaters, perching birds, usually of rather large size, belonging to the family Campephagidae. This family is found in Africa, tropical Asia, the Malay Archipelago, Australia, and some of the Pacific islands, but is most abundant in the Australian region. In Australia and Tasmania eight species occur. No satisfactory popular names have been invented for any of the species; they are known to ornithologists by the names given at the head of the article, though these can hardly be called vernacular.

These birds are as a rule strictly arboreal in habits, and feed largely on beetles, caterpillars, aphides, and other plant-infesting Hemiptera. They often unite in small parties; many have a curious habit of folding and unfolding the wings several times after alighting on a branch, as if the proper adjustment was a matter of some difficulty. Their nests are (considering the size of the birds) extremely small, shallow structures, composed of twigs or wiry grasses fastened together with cobwebs, and usually placed in the forks of horizontal branches. Some species lay only a single egg, others two or three.

Blue Jay.

Throughout the greater part of Australia the most familiar member of the family is the Black-faced Cuckoo-shrike (*Graucalus novaehollandiae*), better known as 'blue jay' or 'blue pigeon.' It is a rather large bird, blue-grey with a black mask on the face, and frequently utters curious, rather raucous, notes as it flies from tree to tree. The Little Cuckoo-shrike (*G. robustus*) is a shyer and smaller species, with less black on the face, fairly common in south-eastern Australia.

The Ground Cuckoo-shrike (*Pteropodocys maxima*), larger and paler than the blue jay,

Ground Cuckoo-shrike.

is almost confined to the inland districts. As its name implies, it is much less arboreal than its relatives and seeks much of its food on the ground.

The White-shouldered Caterpillar-eater (*Campephaga tricolor*)—known as 'spink' in the Riverina—is a summer migrant throughout the greater part of Australia, though in the north it appears to be occasionally resident. The hen-bird is brown with pale underparts; the cock-bird resembles her in the winter, but during the breeding-season assumes a conspicuous black-and-white plumage. He is the best songster of the family, uttering a rapid series of melodious notes, usually when flying from one tree to another. The Pied Caterpillar-eater (*C. leucomela*) is not so common, and is found only in the north and east of the continent. The sexes in this species are more alike, somewhat resembling the male of the commoner bird, but with

White-shouldered Caterpillar-eater.

a patch of orange-buff beneath the tail. The female has, in addition, a series of narrow black bars across her breast. W.B.A.

Cudrania, a genus of the family Urticaceae, consisting of a single species, which ranges from New South Wales into Queensland, and extends to East Africa, India, and Japan. *C. javanensis* (Fustic or Cockspur thorn, the former name referring to a yellowish-brown dye that is made from the heart-wood) is a shrubby climber, armed with stout axillary spines which represent abortive flower-stems.

Cullen, Sir William Portus, born near Jamberoo in Illawarra on 28 May 1855 and educated at the university of Sydney (B.A., 1880; M.A., 1882; LL.B., 1885; LL.D., 1887), was called to the bar in 1883 and soon took high rank on the equity side. In July 1891 he entered politics as member for Camden, his fellow-member being John Kidd; when in 1894 single-member constituencies were created, and Kidd won Camden, Cullen was appointed (on 8 August 1895) to the legislative council. In parliament he was no partisan, and has been described as 'one of those welcome speakers who never rise until they have something to say and always sit down when they have said it.' Outside his profession he was probably most interested in the university, of whose senate he was elected a fellow in 1896, made vice-chancellor in 1908-10, and chancellor in 1914. As far back as 1896 he introduced into council a bill for university reform, including the reforms which were eventually carried in 1912—a limited term of office for senators, and election of them by postal vote. On the death of Sir F. Darley early in 1910 Cullen was (on 28 January) made chief justice of New South Wales, with a dormant commission as administrator of the government during any absence of the governor; this, however, was superseded on 30 March 1910 by a definite appointment to the post of lieutenant-governor. He resigned the chief-justiceship on 28 January 1925. (Kt. Bach., 1911; K.C.M.G., 1912.)

Cunjevoi (1) Popular name of *Colocasia macrorrhiza*, the well-known Green Arum or Spoon Lily (family Araceae), which usually grows in dense masses on river-banks, or in the moister and shadier parts of brush forests, in eastern and tropical Australia. It is also widespread over tropical Asia and Oceania. The spathe is green and spoon-shaped; the leaves spear-shaped, often 2 feet long. The plant is commonly cultivated in suburban gardens. The aborigines use the young bulbs for food, after a careful preparation; first the bulbs are scraped, divided, and put under hot ashes for about half an hour, then pounded between two stones (a large one, *wallarie*, and a small one, *kondola*); all pieces that look watery when broken are then thrown away, and the rest, made into lumps by strokes of the *kondola*, are again put into the fire. This operation is repeated 8 or 10 times, until the lumps are consolidated into a single greenish-grey-coloured mass, the *hakkin*; when this begins to harden it is fit for use. The plant is very acrid when fresh; but heating or drying renders the roots innocuous. The juice of the leaves is used as an antidote to the sting of the Giant Nettle-tree (*Laportea gigas*).

(2) Popular name of a polyp (*Cynthia praeputialis*) common on the Australian coasts. It is often used as bait for fishing.

Cunningham, ALLAN (1791-1839), born at Wimbledon on 13 July 1791, educated at Putney and trained for the law by a Lincoln's Inn conveyancer, found those studies uncongenial and became assistant to Aiton, the manager of Kew Gardens. Aiton recommended him to Banks as a collector, and Banks in 1814 obtained his appointment to collect plants in Brazil, where he spent two years; in August 1816, however, he was ordered to proceed to New South Wales, and reached Port Jackson on 20 December 1816. He was almost at once attached to Oxley's expedition of 1817 (14 April to 29 August), and on return was transferred to P. P. King's survey of the Australian coasts (see EXPLORATION BY SEA), which occupied his time from 22 December 1817 to 25 April 1822. His notes on the botanical results of the survey occupy nearly 40 pages of King's *Narrative of a Survey*, and were thought important enough to be published separately in a German translation. In August 1822 he resumed his botanical researches within the colony, visiting Illawarra, the Blue Mountains and the Bathurst-Mudgee district. In 1823 he began a series of explorations (described under EXPLORATION BY LAND), during which he discovered Pandora's Pass across the Liverpool Range, connecting the Mudgee district with Liverpool Plains (1823), explored those plains (1825), discovered the Darling Downs (1827), and found a way to them from the shores of Moreton Bay (1828). For none of these discoveries did he receive any reward beyond formal thanks. Four months of 1826 he spent botanizing in New Zealand round the Bay of Islands, and in 1830 visited Norfolk Island. By this time he was due for leave; he sailed for England on 25 February 1831, arrived there in July, and settled down for four years at Kew to arrange and name his specimens.

On 31 December 1831 Charles Fraser, the colonial botanist, died, and his position was at once offered to Cunningham, who refused it but suggested the appointment of his brother Richard (q.v.). When Richard died in 1835, the offer to Allan was renewed, and on this occasion accepted. He reached Sydney on 12 February 1837, but found that his duties included too much actual gardening (the government officials having formed the habit of procuring their supply of vegetables from the botanic garden), and other uncongenial work such as the construction of paths along the harbour side. At the end of 1837, therefore, he resigned his position. Gipps, arriving in February 1838, was anxious to retain him in the service, and appointed a committee (including Alexander and George Macleay, Deas Thomson, P. P. King and Charles Sturt) to negotiate with him, at the same time abolishing the 'cabbage-garden' practice. Cunningham thereupon demanded the position of government botanist with a salary of £450 and no responsibility for the botanic garden, travelling expenses for himself and party on trips to out-stations, Tasmania, and New Zealand, and carte blanche as to the disposal of his time. The committee favoured all these demands except the last, which they feared might prove a dangerous precedent—their alternative proposal was six months' leave in every year to prosecute explorations. Gipps, however, calculated that the extra expenditure would amount to at least £850 a year, and declined to authorize it; so the negotiations fell through, and Cunningham on 15 April 1838 left Sydney for New Zealand, where he botanized for six months. For some time his health had been giving way, and he returned from New Zealand 'in a deplorable state of health' to die on 27 June 1839 in a cottage in the Sydney botanic garden. He was buried in the old Sydney cemetery (now the site of the central railway station), and an obelisk was erected to his memory in the botanic garden. When in 1901 the cemetery grounds were resumed for railway purposes, his remains were placed in a casket within the obelisk.

Cunningham, RICHARD (1793-1835), brother of Allan Cunningham, was born at Wimbledon on 12 February 1793 and educated at Putney, following his brother as assistant to Aiton at Kensington and Kew from 1808 to 1832. Charles Fraser, colonial botanist of New South Wales died at the end of 1831, and the position was offered first to Allan Cunningham and then by his advice, and on the recommendation of Robert Brown (q.v.), to Richard. He reached Sydney on 5 January 1833, bringing out with him a selection of vines from France and Spain for establishing the grape-growing industry; these he planted in the botanic garden, which he soon remodelled and improved. In 1833 and 1834 he visited the Bay of Islands in New Zealand (which was then nominally under New South Wales jurisdiction) to collect plants and superintend the felling of kauri pines. In March 1835 he was attached to Mitchell's expedition for the exploitation of Sturt's discoveries on the Darling. No bushman, yet eager to go far afield in search of new plants, he had to be warned on several occasions by Mitchell against losing himself. On 17 April he left the main body to rejoin Mitchell, who had galloped ahead to find a waterhole for the night's camp; failing, however, to notice that the leader had turned sharply northward, he went straight on into dry country, and was never seen again, though his tracks were discovered and followed backwards and forwards, and Mitchell spared no effort to rescue him. His fatal lack of bushcraft doomed him. He was rarely out of sight of the bluegums that grew in neighbouring creek-beds, yet never approached them to look

for water; he was usually within a mile or so of the expedition's tracks (and they were deep and unmistakable), yet never followed them; and, when on the 19th he actually found a note of Mitchell's fixed in a stick in the middle of a small plain, telling him that the camp lay NE., he almost immediately veered to the north-west and then travelled for a day or more due north to and along the Bogan. The dead body of his horse was found, and his whip, and some straps and papers; on the 29th his tracks were noticed near the river, and on 5 May a piece of his coat and fragments of a map were found near a deserted native camp. It was discovered some months later that he had fallen in with a party of natives, who at first befriended him but took alarm at his restlessness and killed him.

Cupuliferae, a family almost exclusively found in the northern hemisphere, consisting of trees or shrubs with unisexual flowers, the males in catkins, the females few or solitary and surrounded by a series of scale-like bracts. The genus *Nothofagus* comprises three species which are endemic in Australia. *N. Gunnii* is a dense, bushy plant confined to several mountain summits in Tasmania, where it often covers a considerable area with an almost impenetrable growth 5-8 feet high. *N. Cunninghamii* (Myrtle or Evergreen Beech), which is confined to Tasmania and Victoria, at low elevations attains a tall forest growth, but at the 4000-ft. level is reduced to a shrub. *Cyttaria Gunnii,* an edible fungus, is parasitic on this tree. Its timber is prized for sash and door work and light joinery. *N. Moorei* is the 'Negro-head' Beech, a handsome tree up to 150 feet, found in the rich brush forests along the northern rivers of New South Wales.

Curlew. See WADERS.

Currawang. See ACACIA.

Currawong. See MAGPIES.

Currency. In the early years of the settlement at Port Jackson barter was the recognized medium of exchange, and rum, corn and wheat the principal articles used as currency. The scarcity of coin is not surprising; for 26 years after George III ascended the throne practically no coins were struck in England, and in 1787 only £55,489 worth of shillings and sixpences were coined. To remedy the deficiency, Spanish dollars and half dollars were in 1797 countermarked with the king's head and made current. Rum was from the first the great circulating medium. A labourer's wages were stated as so many gallons of rum; rewards for the apprehension of escaped convicts were given in rum; for four gallons of rum a wife was purchased from her husband. The effects of using such an unstable article as a circulating medium were very demoralizing. Bligh declared that 'a sawyer will cut one hundred feet of Timber for a Bottle of Spirits—value two shillings and sixpence—which he drinks in a few hours; when for the same labour he would charge two Bushels of Wheat, which would furnish Bread for him for two Months.' Another pernicious element was the varying and exorbitant price charged for rum. The price was continually varying and in 1792 ranged from 5s. to 20s. per gallon. When King arrived, he found that rum which cost the importers from seven to ten shillings per gallon was being retailed at £2. Spirits were bartered by everyone; even Richard Johnson, the chaplain, paid partly in spirits the cost of erection of his 'wattle and dab' church in 1793, and the price of admission to the first theatre in Sydney could be paid in 'money, flour, meat or spirits according to the market price.' The most historic case of the use of rum as currency is connected with the erection of the hospital in Sydney in Macquarie's time, the contractors for which were paid with a monopoly of the spirit traffic for four years. Another form of currency was the store-receipts issued by the commissary for wheat and other articles supplied to the government stores; these were convertible into bills on the London treasury at par, but usually passed from hand to hand and acted as a paper currency.

The first record of a currency regulation appeared in a proclamation issued by Governor King on 19 November 1800:——

Whereas Representations of the Want of small money experienced here has Induced His Majesty to take into His Gracious Consideration the Immediate relief from this great Inconvenience to all Classes of His Subjects in this Colony, a Quantity of Copper Coin has been received in His Majesty's Armed Vessel Porpoise and Royal Admiral, and will be circulated by being paid for Grain and Animal Food supplied His Majesty's Stores.

These are therefore to give notice that a Copper Coin, weighing One English ounce, and stamped with the profile of His Majesty on the one side, and of Britannia on the other, will be issued as above, at the rate of Two pence for each Copper; and that the same shall pass Current in the Colony, and is to circulate at the Aforesaid Rate of Two Pence.

And that no one may plead Ignorance of the Rate or Legality of this or any other of the coins circulating in this Colony, of which it does not appear that any regular Proclamation has ever collectively been issued, I have judged it most expedient herewith to publish the following Table of all the Specie legally circulating in this Colony, with the Rates Affixed to each, at which they shall be considered and be a legal tender in all payments or transactions in this Colony.

	£	s.	d.		£	s.	d.
A guinea ...	1	2	0	A rupee	0	2	6
A half-Johanna	2	0	0	A Dutch guilder	0	2	0
A gold mohur	1	17	6	An English shilling ..	0	1	8
A Spanish dollar	0	5	0	A copper coin of 1 oz. ...	0	0	2
A Johanna ..	4	0	0	Ditto., ½ oz...	0	0	1
A ducat	0	9	6	Ditto, ¼ oz...	0	0	0½
A pagoda ...	0	8	0				

When a sufficient quantity of Copper Coin is received in the Colony, of which notice will be given, no private *Notes* or *Cards* will be allowed to Circulate.

This Supply of Copper having been sent to relieve the Inconvenience of persons requiring to make small payments, no persons are to Collect the same for the purpose of making large payments, nor shall it be deemed a legal tender to offer the same in payment for any sum exceeding five pounds.

And it is hereby declared that the Exportation or Importation, except from His Majesty's Treasury, of any sum exceeding five pounds of the above-named copper coin, shall be punished by fine of treble the value, and forfeiture of the sum exported or imported.

Only £550 worth of copper coin was brought out in the *Porpoise.* As C. P. Hyman (*Coins, Coinages and Currency of Australasia*) points out, by this proclamation the local values of the various coins were deliberately enhanced in order to 'keep the money in the country.' Thus the Johanna was a Portuguese coin worth outside New South Wales about £3 12s., mohurs in India passed for about £1 12s., and rupees

for 2s. 3d.; the copper coins, it will be noticed, are actually doubled in value. Yet Collins laments that the copper coinage was not distinctively marked 'to prevent its being taken out of the Colony.' Copper coins, however, were not scarce by 1810, for we find in that year a government proclamation threatening that persons neglecting to consolidate their store receipts within the time ordained 'subject themselves to be paid in Copper Coin.' In November 1816 Macquarie was advised to call in the copper coin, which had depreciated in value, and reissue it at a more suitable value in sterling. On 7 December, therefore, he proclaimed that all copper coins of 1800 or previous years would be accepted up to 1 January 1817 at 1½d. for each penny piece, but after that date would be worth only the face value.

Paper Currency.—The store receipts referred to above proved so useful as a paper currency that the government found a difficulty in collecting them to be exchanged for bills. In 1815 Macquarie deemed it desirable, in view of the lack of specie, to reintroduce them. A government order of 25 March read:—

> In order to obviate the inconveniences that are likely to result to the Public from the want of a Sufficient Quantity of *Specie* belonging to Government, His Excellency the Governor deems it advisable to resort again to the System, formerly pursued in this Colony, of issuing *Store Receipts* for all Purchases made on account of the Crown, not only at Headquarters, but also at all the out and Subordinate Settlements, dependent on this Territory.
>
> The Governor accordingly hereby orders and directs that, from and after the 24th Day of the ensuing Month of April, all Purchases of whatever kind or Description, made on account of Government, shall be paid for in *Dollars* or in *Store Receipts*. . . .
>
> These Store Receipts are to be brought into the Deputy Commissary General at Head Quarters for Consolidation, regularly at the End of every two Months, and all Persons possessing them are strictly enjoined to be punctual in doing so. . . .

In 1819 the system was discontinued, but revived again in the following year, and continued in use for some years.

The dearth of small coin at Port Jackson and in Van Diemen's Land led merchants and traders to issue promissory notes for amounts as low as threepence; these became known as 'currency,' as distinguished from 'sterling' specie or government money. For some years they were readily absorbed by the community, but in course of time were depreciated by abuse; forgeries were frequent, and the consequences arising from lack of control of issue were well summarized by W. C. Wentworth in his *Description of the Colony of New South Wales* (1819). The whole burden of providing a circulating medium, he says, fell on the colonists, many of whom promptly became bankers and issued promissory notes; this 'colonial currency' was soon worth only half its face value in government money, and yet the issuers were compelled by law to redeem it at par on presentation. Consequently the most solvent traders withdrew their notes, and with government money bought up for trading purposes the depreciated notes of their weaker fellows; lacking sound support, the notes depreciated still further—and yet had to be used for the lack of any other medium. The public, therefore, 'thus affixed a kind of nominal value to that which is in reality worth nothing.'

In June 1810 it was ordained that all promissory notes for £5 or less must be printed, hand-written notes having been forged wholesale. They must be drawn for the payment of a certain sum sterling, and non-payment of the amount within three days after demand rendered the defaulter liable to penalties. In November 1816 it was deemed expedient to authorize the circulation of sterling money or 'promissory notes for the payment of the same in Sterling Value and Amount only,' and it was declared unlawful for any person to issue or negotiate any promissory note which did not express and declare that the amount thereof was payable in sterling money. In continuation of the policy of eliminating unstable currency a further proclamation was issued on the 25th insisting that all prices quoted for purchases, wages, etc., must be specified in sterling; and on the 29th a meeting of officials, free settlers and traders decided that sterling prices should be two-thirds of the former currency prices, and that contracts and bargains payable in currency should be reduced to sterling by deducting from one-fifth to three-sevenths of their value to represent the existing depreciation. The circulation of promissory notes, however, continued until 1826, when an act prohibited their issue for amounts less than 20 shillings sterling. By this time the Bank of New South Wales was in operation, and the circulating medium had assumed something like stability.

The Spanish Dollar.—In the return issued by King on 19 November 1800 (previously quoted) the Spanish dollar is set down as worth five shillings. This coin played a large part in the currency not alone of New South Wales but of the whole world; and Brisbane on one occasion described it as 'an invaluable coin, which has for centuries been disseminating its benefits over every other portion of the earth—a coin which, from the extension of its circulation over every part of the commercial globe, may justly be defined the money of the world . . . Driven, indeed, from the United Kingdom by her moneys of sterling denomination, it still maintains all its pre-eminence in every one of her Colonies. Confined in its advantages to no faith, kindred, or Government, it has for ages been bestowing sterling benefits on the British and Protestant North American Colonies; on the French and Papal Canadas; on Mahomedan India; and on the whole world.' Its history is therefore worth considering.

For several centuries practically the whole coinage of the European world and its dependencies came from Mexico, where a mint was established in 1535. From this mint were issued the 'Spanish dollars' or 'pieces of eight' so well known to buccaneers and captors of treasure-ships. The sign $ now used to signify the United States dollar is supposed to derive from the Spanish 'pillar dollar' of eight reals; the curved portion of the sign is a rude 8, and the vertical stroke is a symbol of the Pillars of Hercules, an emblem of the Spanish Empire. Pieces of eight were known by that name until about 1728, after which date they were called dollars—a name originally invented for silver coins of equivalent value minted in a Bohemian valley (*thalers*, from Joachims Thal).

These dollars circulated throughout the world, and the English colonies of North America adopted them as early as 1704 on an equality with English sterling coins; their value, in the 17th century 4s. 6d. each, rose by 1782 to 7s. 6d. in most ports and even 8s. in New York. Between 1790 and 1812 the Mexican mints

turned out 24 millions of them, but they were so much in demand that New South Wales, whose chief silver coins they were, could not retain them; in 1804 Governor King mournfully wrote:—

> The fallacy of endeavouring to keep Spanish dollars or any sterling coin within the Colony has long been proved, even when the former has been cut into eight or ten parts, as these coins are never seen after they are paid away.

Occasionally, however, there was a windfall of them. In the very year of King's complaint an English whaling vessel attacked a Dutch vessel off Sumba, captured her after a midnight fight (11.30 p.m. to 1.30 a.m.), and brought her into Port Jackson with £20,000 of Spanish dollars aboard. King did not feel justified in handling so huge a financial transaction, and refused to buy the coin, but a good deal of it remained in the colony.

Macquarie was the first governor to hit on a really effective method of preventing the re-exportation of dollars. Having received in November 1812 a consignment of £10,000 worth of dollars by the *Samarang*, on 1 July 1813 he issued a proclamation directing

> that a small Circulating piece of Silver shall be struck out of the centre of every such dollar, which together with the remaining part of every such dollar is intended to be issued and circulated, at the value and under the regulations hereinafter described . . . that each and every small Circular piece of silver, on one side of

HOLEY DOLLAR

Obverse

Reverse

DUMP

> which is impressed with the figure of a Crown, the words 'New South Wales,' above such impression, and the figures 1813 beneath the same, and the other or reverse side thereof are impressed the words 'Fifteen Pence,' and having the Edges thereof Grained, shall be current within the territory for the sum of fifteen pence of lawful Money of the United Kingdom of Great Britain and Ireland, of English value and Currency . . . that every such larger piece of Silver, being the remaining part of every such dollar, on the upper part of one side of which are impressed, at its inner rim, the words 'Five Shillings,' and at the lower part of the said Rim, on the same side is also impressed the figure of a Branch of Laurel, and on the reverse side of which, at the Upper part of the said inner Rim, are impressed the words 'New South Wales,' and at the lower part of the same Rim the figures 1813, the Edges of the said inner Rim being grained on both sides, shall be current within this territory, and every part thereof, for the sum of Five shillings of lawful Money of the United Kingdom of Great Britain and Ireland, of English value and Currency.

This dollar became generally known as the 'holey dollar,' while the smaller piece removed from the centre was called the 'dump.' It was found necessary to engage to receive these coins back again into the treasury, at their current value, at the expiration of every two years in exchange for bills on England. It was anticipated that the issue of these dollars and dumps would correct the currency trouble, but these hopes were not realized. Counterfeits soon appeared, and the Bank of New South Wales in 1821 found it necessary to issue a notice drawing attention to the illegal coins in circulation, which were described as

> Dollars and Dumps which are not Silver; Dollars, having the usual Holes in the Centre, but without the Colonial Stamp on them; Colonial Dollars, from which a portion of Silver has been taken round the Centre, whereby the Hole is made considerably larger; and Dollars that bear a Counterfeit Stamp, intending to imitate the Colonial one surrounding the Hole in the Centre, many of which may be detected by the Figures for the Date of the Year, being transposed from 1813 to 3181.

Up to 1822 it was the practice in New South Wales to express money-values in dollars, and even government notices followed this custom. But in May of that year the directors of the Bank of New South Wales issued a notification that they declined to receive Spanish dollars until a specific value was fixed by the government. They pointed out that the dollar had hitherto circulated at a nominal value of 5s. sterling, which was nearly 17 per cent above its value as bullion; that within the last three months dollars 'to a very alarming amount' had been imported into the colony; and that through such an influx of specie the nominal value could not be maintained unless the government continued to make their sterling payments in a foreign coin, thus rendered a legal tender.

Brisbane, who was an ardent advocate of the Spanish dollar, attempted to place the currency on a sound basis by making the dollar the standard of value in the colony; to effect this, 400,000 dollars were imported and issued at the regulation rate of 5s. in payment for supplies, and notice was given that colonial duties and government quit rents would be received in these coins at the like rate. On 28 July Brisbane further ordered that the holey dollars of 1813 should be exchanged at their rate of issue if tendered for exchange within six weeks; these coins were reissued at the end of the year, and passed current for three-fourths of the Spanish dollar. The results of Brisbane's policy are severely criticized by Robert Chalmers in the book mentioned at the end of this article.

On 4 May 1825 the governor notified that Spanish dollars would be received at an exchange of 4s. 4d. in sterling money in all payments into the colonial fund. In the same year the British government arranged for a supply of British silver, and on 31 December the governor issued a general order fixing the value of Spanish dollars at 4s. 4d. and 'Calcutta or sicca rupees' at 2s. 1d. For the future, also, government accounts were to be made up and stated in sterling. An act passed on 12 July 1826 repealed the 1824 act respecting notes, prohibited the issue of notes of less denomination than 20s., and confirmed the just ordained value of the Spanish dollar. The commissary in New South Wales at first found a difficulty in providing a sufficiency of British coin, but this was met by the importation of £55,000 in British silver. In October 1827 about £7000 of this was in general circulation, £14,000 in the two banks, and the other £33,000 in the military chest. But the British money soon was absorbed into general circulation, and on 24 September 1829 the military chest contained

British silver coin	£12	8	0
British copper coin	701	14	8
Ring dollars, 27,161 at 3s. 3d.	4413	13	3
Spanish dollars, 3432 at 4s. 4d. ..	743	12	0
Rupees, 734 at 2s. 1d.	76	9	2
Dumps, 10,103 at 1s. 1d.	547	4	11

The general order of 16 December 1828 was the first decisive step towards withdrawal of the holey dollars; it stated that 'ring' dollars would be received at the colonial treasury in exchange for bills on the British treasury at 3s. 3d. each, and dumps at 1s. 1d. On 23 November 1829 the traders and shopkeepers of Sydney unanimously resolved to accept the Spanish dollar at 4s. 2d. and the rupee at 1s. 9d. only; and from this date the Spanish dollar gradually disappeared from the currency of New South Wales, although it was retained in Tasmania until an act of the Tasmanian legislature (14 September 1842) decreed that from 1 October of that year foreign coins should cease to circulate legally.

The discovery of gold in 1851, and its consequent output, created a demand for a mint at which it might be coined. There was not sufficient coin in the colony with which to buy the gold produced, and gold dust of over the standard fineness was commonly sold in Sydney for about £3 per oz. A committee of the legislative council recommended that a request should be made for the establishment of a mint in Australia, and a petition to that effect was despatched, dated 19 December 1851. Melbourne, however, protested strongly against the establishment in Sydney of the sole mint for Australia. Formal authority for the establishment of a branch of the royal mint was given by an order in council of 19 August 1853, and designs for the new sovereign and half-sovereign were approved on 18 October 1854. The New South Wales legislature then passed an act (No. 39 of 1854) which provided for a gold coinage at Sydney identical with, and equivalent to, that of the United Kingdom, and followed it up with another (No. 3 of 1855) to regulate the local currency, which is in force in New South Wales at the present day. This second act provided that the gold coin issued from Her Majesty's mint in London and the gold issued from the branch of the royal mint in Sydney, should be the only legal tender for payments within New South Wales, except that silver coin, whether British or Australian, should be legal tender up to 40s. at one time. The Sydney branch was opened on 14 May 1855, and between that date and the end of 1859 coined over five millions worth of sovereigns.

In 1856 the New South Wales legislature asked that the Australian sovereign might be declared a legal tender throughout the Queen's dominions, and after some delay a British act (26 and 27 Vic. C. 74) was passed on 28 July 1863 'to enable Her Majesty to declare gold coins from Her Majesty's branch mint at Sydney, New South Wales, a legal tender for payment and for other purposes relating thereto.' The necessary proclamation was made on 3 February 1866, and a further proclamation (of 10 November) declared the Sydney sovereign and half-sovereign a legal tender for all the British colonies except Canada and Newfoundland. This exclusion was cancelled on 14 May 1868. The Sydney mint was first employed in the issue of imperial bronze coins in 1868, and of imperial silver coins in 1879.

Up to 1851 *Victoria* had no currency history distinct from that of New South Wales. The legislative council of Victoria on 31 July 1852 asked for the establishment of a mint in Melbourne. The proposal remained in abeyance for some years; but by an order in council of 7 August 1869 authority was given for the establishment of a branch mint at Melbourne, to strike gold and other coins, and a proclamation of the same date declared gold coins struck at the Melbourne mint to be legal tender in all places where the London sovereign was a legal tender. The new mint was opened on 12 June 1872.

Peculiar gold pieces were struck in Victoria in 1853. On the obverse of the design are the words 'Port-Phillip, Australia' incused upon a broad rim, which is in relief. The date—1853—is placed under a kangaroo. On the reverse are the words 'Pure Australian Gold,' with the weights in words and numerals of the various pieces struck—¼, ½, 1, or 2 oz. It was intended by the strikers that these pieces should pass current locally at £1, £2, £4, and £8; but by the time the machinery was in working order gold was fetching £4. 4s. an ounce and English sovereigns were plentiful. The enterprise was therefore abandoned. It is probable that only a single set was ever issued in Victoria, but replicas have been made from the original dies for museum purposes.

In 1825 *Tasmania* was erected into a separate colony, and encountered the same trouble with paper currency and the fluctuating values of the Spanish dollar as did the parent State. On 2 September 1835 a local act made the sicca rupee legal tender at 2s.—but this act was disallowed by the home government. The South American dollar (which took the place of the Spanish dollar after the revolt of the Spanish colonies in America) was legalized in 1834 at a value of 4s. 4d.; the banks refused to regard the new coin as legal tender, and an act of 28 November 1838 legalized them, but in 1842 the act 6 Vic. C. 7 demonetized them again, and they gradually disappeared from the currency. Gold coins of the Sydney mint were declared legal tender on 18 October 1854 and those of the Melbourne mint on 7 August 1869. The only other official act affecting the currency of Tasmania was the issue of a proclamation on 11 October 1875, whereby the old British copper coins were demonetized, and British bronze coins were declared a legal tender.

South Australia.—The first reference to South Australian currency is to be found in the colonization commissioner's instructions to Colonel Light, dated March 1836—'You will pay the wages of the labourers under your command by orders on the storekeeper, whenever it can be done conveniently. The storekeeper is supplied with specie to the amount of £100, and has instructions to honour such orders. Printed forms for the purpose will be prepared for your use.' The necessary forms were printed in London for issue after Colonel Light's arrival in the new colony. The issues appear to have been limited to sums of 10s. and 2s., the latter being the daily rate of wages of the labourers employed on the survey. The directors of the South Australian Company also provided a paper currency by the issue of orders for 10s., 5s., 2s., and 1s. and 6d. respectively. These notes were all dated from 'Kingscote, Kangaroo Island June 1st 1836,' a date prior to the arrival of the Company's ships at the island, and several months before the site of the new settlement of Kingscote had been determined. Notes to the value of £10, £5, and £1 were also issued by the company. Early in the fifties a number of promissory notes were issued by the South Australian Company and by various merchants. One, issued by Robert Radford, promised to pay the bearer the sum of 2d. in cash.

The outstanding feature of South Australian currency is the coining of what are known as 'Adelaide sovereigns' under an act of the colonial legislature without the permission of the British government. On 9 January 1852 Adelaide merchants petitioned the then governor (Sir Henry Young) to minimize the evils attendant on gold discoveries in neighbouring colonies. Coin was being drained, they said, from South Australia to purchase Victorian gold-dust, which was not a good circulating medium; if the South Australian government could 'receive, assay and coin (i.e. stamp)' the gold, and agree to accept such coins in payment for land-purchases and taxes, the situation could be stabilized. The resulting bullion act (28 January 1852) legalized the assaying and stamping of parcels of gold over 20 oz. in weight, and ordained that banks should exchange their notes for gold bullion at the rate of £3 11s. per standard oz., 22 carats fine. Under this act the government assay office stamped and issued ingots of various weights; the Adelaide banks handled in this shape gold to the value of about 1½ millions sterling. The operation of the 1852

Rubbing from an 'Adelaide Ingot.'

act was limited to 12 months: but an amending act, passed on 23 November, besides authorizing the issue of coins of the value of £5, £2, £1, and 10s., provided for the continuance of the assaying and stamping system so long as not less than 4000 oz. of gold was brought to the office for that purpose each month. Dies were made for coins of the £5 and £1 values, but only about half a dozen £5 pieces were struck, and none put into circulation. Of the £1 pieces nearly 25,000 were struck and circulated: when, however, it was discovered that each contained £1 1s. 10d. worth of gold, they were quickly bought up and the bulk of them exported to England as bullion. On 14 February 1853 the assay office was closed, the amount of gold brought in having fallen below the required limits.

Another novelty in South Australia was a copper coin about the size of a farthing, struck for a man named Tilley Cook in 1855, and inscribed 'Hindmarsh Hotel,' encircling fourpence; and a firm of upholsterers (Congrave) issued little round pieces of leather stamped as pence and halfpence.

Queensland has no separate currency history. In *Western Australia* the earliest currency (1830) took the form of promissory notes issued by the government in payment of work done for it or stores purchased. Such coins as circulated were British; dollars do not seem to have been used. In 1852 it was discovered that a clerk employed to write out the notes had duplicated many of them and forged the official signatures thereto, and the issue had to be called in. A certain Peter Brown appears to have filled the gap with promissory notes of his own, and by 1835 the government departments were accepting private notes in payment of customs duties. In that year, however, the government was itself issuing £1 notes as a temporary expedient, and the commissary reported that on 8 October he had in his chest £148 worth of gold coin, £271 worth of silver coin, and £214 worth of one pound notes. About the subsequent history of Western Australian currency there are no special features; in 1852 British coins were formally made current, in 1856 the Sydney-minted coins, and in 1869 those of the Melbourne mint. In 1894, when it was obvious that Western Australia would be one of the great world-sources of gold, application was made for the establishment of a mint at Perth, and this was opened for business on 20 June 1899.

Tokens.—In the 17th century the lack of small change in England led to the issue of large numbers of 'tokens'—copper coins impressed with the advertisement of the person issuing them, and usually passing current for 1d., ½d., or ¼d. At the end of the 18th century large issues of these tokens were again made, but a large issue of pennies between 1797 and 1805 obviated the necessity for them, and on 27 June 1817 the further issue and circulation in England of tokens was prohibited. The early colonists of New South Wales, as we have seen, used promissory notes of small value to supply the deficiency of copper currency; but the opening up of the Burra Burra copper mines made that metal plentiful enough to allow of the use of tokens in Australia. Annand, Smith & Co., grocers in Melbourne, issued in 1849 1d. tokens struck in Birmingham. The first dated tokens, however, were made in Sydney of Burra Burra copper (or from the funnel of an old steamship) by J. C. Thornthwaite, an engraver who had arrived from England some three years earlier; he had no screw press, and was compelled to cut the coins with a drop-hammer. These tokens were issued by Samuel Peek, a Sydney grocer who owned tea stores and steam coffee mills, and advertised them on the obverse of his token, placing a helmeted figure of Britannia on the

reverse. Thornthwaite also in 1854 struck some silver coins (3d.) to the order of James Campbell of Morpeth; but the first silver token known to Australia is the scarce silver 1s. piece issued by a Tasmanian firm (MacIntosh & Degraves) in 1823—this, however, was not generally circulated, and may have been a memento rather than a coin intended for currency. Between 1852 and 1868 a great number of copper tokens were issued by storekeepers in the various colonies—over 400 varieties altogether. All trades were represented, but a few tokens were issued to commemorate historical events; thus ½d. tokens were issued in Melbourne 'to commemorate the landing of Sir Charles Hotham 22 June 1854,' and a firm of Sydney grocers issued pence and halfpence 'to commemorate the opening of the Sydney Railway 26 September 1865.' By 1863 a demand had arisen for the withdrawal of tokens and the substitution of official coin, and storekeepers in many cases refused to accept tokens. Their prevalence is shown by returns presented to the deputy master of the Sydney mint in 1863, which state that in one case 'out of 68 copper pieces in the till of a shopkeeper, but one was a genuine British coin,' and in another 'but 6 out of 37 were British coins.' The circulation of tokens, however, continued until 1868. On 2 September in that year it was officially announced that old copper coin of the realm would be exchanged for new bronze coin at its full nominal value plus a premium of 2 per cent to cover expenses of collection, packing, and delivery at the mint; that for a period of one month from date copper tokens in circulation would be exchanged at the rate of 240 bronze pence for every 8 lb. of tokens; but that anonymous tokens, those roughly cast and only recently circulated, and evident counterfeits would not be exchanged. These concessions were withdrawn on 22 March 1869. The pieces withdrawn were nominally valued at:—

Old copper coins	£1191	5	2
Old copper tokens	1240	10	4
Total	2431	15	6

The total weight was about 10 tons.

Coinage under the Commonwealth:—The governments of New South Wales and Victoria received permission in 1898 to coin at Sydney and Melbourne silver and bronze for circulation in Australia, but no steps were taken in the matter. Under the federal constitution currency and coinage became federal matters, and in 1909 an act of the Commonwealth parliament provided for Australian coinage as follows:—gold, £5, £2, £1, and 10s.; silver, 2s., 1s., 6d., and 3d.; bronze, 1d. and ½d. Gold was to be legal tender up to any amount, silver up to 40s., and bronze up to 1s. Ultimately the coining was to be done in Australia, but a temporary agreement was made with the London mint, and orders were given for £200,000 worth of silver. The first consignment arrived in Australia early in 1910. Copper coins to the value of £10,000 were also ordered and supplied. Under the federal constitution the issue of paper money is controlled by the Commonwealth, and the parliament in 1910 prohibited the further issue of notes by private banks. Until Commonwealth notes were available, the federal treasurer was empowered to take over the reissue notes of private banks with a Commonwealth surcharge. The new 'Australian' notes, which were first issued in December 1910, were made legal tender throughout the Commonwealth and all Territories under the control of the Commonwealth, and were payable in gold on demand at the Commonwealth treasury in Melbourne. The treasurer was bound by an act of 1911 to hold a gold reserve of not less than one-fourth of the amount of Australian notes issued and not redeemed. Notes were to be of the value of 10s., £1, £5, £10, or any multiple of £10.

As a result of this legislation the private banks' notes, which for many years previously had fluctuated between 3 and 3½ million pounds' worth, were replaced by an issue of Australian notes whose value within two years amounted to 9½ millions; of this amount 5 millions was held by the private banks and 4½ millions was in circulation, while the Commonwealth's gold reserve amounted to nearly 4 millions. The strain of the war greatly altered this position. Towards the end of 1914 it was found impossible to borrow in London for public works within the States, and the federal government agreed to lend five of the State governments (Queensland standing out) £18,000,000; to raise this amount it (among other devices) arranged with the bigger private banks for a loan, not bearing interest, of £10,000,000 in gold, and deposited with them Australian notes for that amount on the understanding that they would not be presented for payment before the end of the war. The gold thus acquired was then used as a reserve to guarantee further issues; gold coin consequently almost ceased to circulate, the note issue was hugely expanded, and at the end of June 1919 55½ millions' worth of notes was either in circulation or in the banks' safes, the gold reserve amounting to 24½ millions. In December 1920 the management of the note issue was transferred to the Commonwealth Note Issue Board (see COMMONWEALTH BANK), and in 1923 there began a new issue of notes with superscriptions corresponding to the change. The note issue remained fairly constant during 1921-3, at a figure slightly in excess of £50,000,000. Notes in circulation on 30 June 1922 amounted to £53,556,698, of which approximately four sevenths were held by the banks and three-sevenths by the public. Against this there was a reserve of gold coin amounting to £23,347,797 10s. (nearly 44 per cent) and, among other assets, investments of the value of £29,658,482.

See Hyman's *Coins, Coinages, and Currency of Australasia* (Sydney, 1893); Chalmers's *History of Currency in the British Colonies* (London, 1893); Atkins's *Coins and Tokens of the Possessions and Colonies of the British Empire* (London, 1889); Gill's *Brief Sketch of the Coinage and Paper Currency of South Australia* (Adelaide, 1912); and Andrews's *Australasian Tokens and Coins* (Sydney, 1921).

Currents, Oceanic. The scientific investigation of the ocean currents whose course lies adjacent to the coasts of Australia has been until lately much neglected. Cook, Vancouver, Flinders, and Bass made some observations on the currents they encountered, as did P. P. King (1820-4), Wickham and Stokes (1837-43), and Denham (1858) while surveying the coast-line; and since 1872 the admiralty has carried out detached coastal surveys, mostly on the northern and north-western coasts. Many isolated observations on the direction and velocity of some of the currents have also been made by chance visitors—the French frigate *La Venus* in 1832, Wilkes in 1840, Sir James Ross in 1841, H.M.S. *Challenger* in 1874, the German survey-ship *Gazelle* in 1875, and the U.S.S. *Tuscarora* in 1874-6.

All these observations, however, were confined to a single season of the year in each case, so that the results obtained must be regarded as applying to that particular time and place only.

It is always dangerous to generalize on insufficient data on any scientific subject, but particularly so as regards ocean currents. There are so many unknown elements in the problem to be solved that its unravelling is only possible through a long series of carefully and accurately conducted measurements. Even the best results obtained by the most competent and highly trained observers can only be regarded as items in a series; and the value of our conclusions must be gauged by the number of items considered, and the care taken to relate them properly to seasons and to certain physical conditions. From the paucity of available observations, therefore, any conclusions concerning Australian ocean currents must be regarded as more or less tentative. This obvious fact has not commended itself to all writers on the subject, and the alleged width, depth, seasonal movements, and ultimate destination of some currents, set out in unequivocal language, though estimated from only one or two observations, have been proved by subsequent measurements to be entirely wrong.

By the general reader, and by the ordinary mariner, an ocean current is taken to mean a movement of surface-water—i.e. of that portion which directly affects the movement of a vessel; but a little consideration will convince us that surface-water (above, say, three fathoms) is the most unstable part of the stream. A solid mass of water hundreds of miles long, scores of miles wide, and hundreds of feet deep, is not turned aside by any temporary disturbance of the atmosphere; yet, if its velocity is sluggish, the movement of its surface-waters may be accelerated or retarded—or even reversed—by long-continued winds from one direction, to be again restored to its normal direction when the wind drops or the direction changes. In this article 'current' means the main body of water, the movements of which are being described; surface, sub-surface and bottom currents are described as such.

Southern Ocean Current.—The southern shores of Australia, for a length of about 2400 miles, are swept by a world-engirdling stream, impelled by the anti-trades or 'roaring forties.' The unobstructed path of these westerly winds completely round the earth, approximately between 40° and 50° S., causes an easterly drift of the surface-water, known as the Southern Ocean current. This creates an indraught of water from the Antarctic, running towards the NE.; and the passage of so vast a quantity of cold water close to our southern shores has a very pronounced effect on the climate of a large portion of the continent. There is also an indraught of warm water from the Indian Ocean—which, having no outlet to the north (as have the Atlantic and Pacific Oceans), must discharge the whole of its warm and comparatively light waters southwards. We are, unfortunately, destitute of information as to the width, depth, velocity, or location of this discharge; but we know of a warm southerly and easterly drift (with seasonal variations) from near Cape Leeuwin at the south-western corner of Australia; and the *Challenger* observations show that a warm current, about 400 miles wide and about 250 fathoms deep, flows in an easterly direction off Cape Northumberland. At Cape Leeuwin it is a surface-current, but at Cape Northumberland is about 150 fathoms down, and has cooled to the extent of about 16° F.

As the great Southern Ocean current of cold water approaches the SW. point of Australia, it meets the warm southerly drift from the Indian Ocean; its waters being heavier, it dips below the warmer stream and flows as a subsurface-current until it meets the shore-line. It bifurcates, probably between 400 and 500 miles SW. of Cape Leeuwin, one part following the western coast of Australia northwards as far as Shark Bay, the other running E. along the southern coast as far as Bass Strait. The branch which flows northward dips under the warm southerly drift from the Indian Ocean, but upwells in the immediate vicinity of the shore-line, forming a cold belt that varies in width according to the strength and duration of the offshore winds. There is not sufficient information to enable us to say how far W. it extends as a subsurface-current.

The southern branch continues as an easterly surface-current across the Bight, with a rate varying from .3 to .4 knot, as far as Spencer Gulf. The warm current from the Indian Ocean, which up to that point appears to be confined to the Bight, dips under and becomes partly merged in the main stream; the combined currents follow the general trend of the shore-line until they strike the Tasmanian plateau. This obstruction blends more thoroughly the warm and cold waters, so that the water in Bass Strait is usually from 2° to 4° F. colder than the water off Cape Northumberland. The Tasmanian plateau also slows down the current-velocity in Bass Strait to such an extent that the tidal currents become the more important; both are, to a large extent, dominated by the wind. The main body of the Southern Ocean current sweeps along the western side of the plateau, turning at the southern coast of Tasmania sharply and with increased velocity to the left, and continues its course NE. and E. round the world.

Eastern Australian Current.—The Eastern Australian current, unlike that of the Southern Ocean, is a stream-current—a branch of the South Pacific Equatorial current, which, after passing S. of the Fiji Islands and New Caledonia, is deflected towards the Australian coast. It first strikes our shore-line near Great Sandy Island, is again deflected (this time to the southward), and flows close alongshore as far S. as Jervis Bay; there the coast-line bends slightly W., but the current continues its direct course until it impinges upon the eastward-flowing Southern Ocean current in about 43° S. It is here split into three portions. The first is bent round and flows E. as a warm surface-current; the second is also carried E., but mixes with the colder current and helps to account for the rise of temperature—from 41° to 50° F., according to the season—which is observed between 50° and 40° S.; the third—the water that has already become cooler and therefore heavier—sinks below the cold surface-water, takes a south-easterly course, and flows as a comparatively warm under-current into the Antarctic Ocean. This warm water, in conjunction with that of the Brazilian current in the South Atlantic, and the Agulhas or Cape current of the Indian Ocean, undermines the enormous ice-masses that form the 'ice barrier,' and detaches from them numerous floating icebergs, which strew the face of the Southern Ocean even in 50° and 40° S. These ice-masses, melting, produce water which, being of less specific gravity than the salt water of the sur-

rounding sea, at first floats upon it; eventually, however, the two layers blend (combining the density of the salt with the temperature of the fresh water), and sink, becoming the source of the masses of cold water which, to a depth of several thousand fathoms, fill up the basins of the Atlantic, Pacific and Indian Oceans.

The eastward surface-current, meanwhile, continues its journey till it strikes the western coast of New Zealand, where it is again deflected N. along that coast as far north as Cape Maria Van Diemen; there it turns W. and is lost in the waters of the Tasman Sea.

Between Great Sandy Cape and Jervis Bay the Eastern Australian current (for which the name 'Tasman current' has been proposed) has at 34° S. a width of 350-400 miles and a depth of about 100 fathoms. Its velocity on the New South Wales coast, at all times and seasons, is about 1½ knots at the littoral, and about 2 knots in the offing. Between Jervis Bay and Bass Strait the direction and velocity of this current is variable, as it is very sensitive to interference from a northerly extension of that part of the Southern Ocean current which flows E. through Bass Strait. The area between the shore and the western edge of the Tasman current is occupied by branches of the warm and the cold currents alternately, according as the wind blows from the south-western or from the south-eastern quadrant. On the west coast of New Zealand the temperature of the stream is from 8° to 10° F. warmer than on the east coast, but the information available is not sufficient to enable us to state its dimensions.

The western equatorial drift in the eastern South Pacific, caused by the SE. trades, will be found to extend to about 20° or 22° S. As already said, a portion of its waters is deflected towards the Australian coast at about New Caledonia; the rest flows NW. towards Cape York, and so through the Arafura Sea. Within the triangle formed by New Caledonia, Cape York, and the Chesterfield reefs, the currents are uncertain both as regards direction and velocity, being influenced largely by the prevailing winds—and, when close to the shoreline, by very complicated tidal currents, which are partly produced by local conditions among the numerous islands.

Arafura Sea Currents.—In the Arafura Sea the current generally sets with the wind, its course in the SE. monsoon season (from the beginning of April to the beginning of October) being W. The velocity depends much upon the force of the wind, but seldom exceeds 1 or 1½ knot. Along the northern side of the Sirmatti Islands—between Timor and the Tenimber group —the current sets E. (to windward) during the SE. monsoon season. During the NW. monsoon the currents in general set E.

On the NW. and W. coasts of Australia the current, though generally setting with the wind, is sometimes uncertain both in velocity and direction, being complicated with strong tidal currents which prevail in those parts. The range of the tides between Van Diemen Gulf (in 132° E.) and Dampier Archipelago (in 116° 30′ E.) is abnormally great, ranging from 19 to 38 feet at springs; the average of 22 stations is 26 feet. The greatest rise and fall on this coast—38 feet—occurs in Hanover Bay (in 124° 45′ E.) but at neaps the range is reported to be at times only two feet. Such large masses of water, entering and leaving the gulfs and bays, necessarily cause serious indraughts and extensive outdraughts, and these, being further complicated by great diurnal inequality, are a menace to safe navigation.

To the W. and S. of Dampier Archipelago the range of the tides lessens, being about six feet at North-west Cape and dwindling to about two feet at Fremantle. On this part of the coast the currents, as already said, are sluggish and uncertain. The warm drift from the Indian Ocean and the relatively cold current from the Southern Ocean encroach upon each other alternately, with the result that the offshore and onshore winds often dominate the set. The prevailing winds have a tendency to blow from the western quadrants, thus setting a vessel towards the land when in the vicinity of the coast.

G.H.H.

Cuttle-fish. See MOLLUSCA.

Cyanostegia, a genus of the family Verbenaceae, consisting of shrubs, mostly endemic in Western Australia. The flowers are blue; calyx broadly bell-shaped; leaves opposite. The frilled papery calyx, with a sinuate toothed margin, enlarges as the corolla withers, and retains its form and colour, simulating the 'everlastings.' The leaves are often covered with a glutinous exudation.

Cycadaceae, a family of palm-like plants extending over tropical America, subtropical and southern Africa, and tropical Asia. Three genera are indigenous to Australia. The flowers are unisexual, on different plants, without calyx or corolla; the males consist of scales bearing anthers, the females of cones (also represented by scales) on which the naked ovules are seated. The endemic genus *Macrozamia* has 16 species. The kernels of the nut-like fruits of various species, after being pounded, macerated and baked, form an important article of aboriginal food. They contain a large quantity of starch, which is easily obtained by washing the crushed kernels; if eaten without preparation (i.e. washing or cooking) they are very poisonous. Officers of the Flinders expedition suffered severely from eating the raw nuts of *Macrozamia Fraseri*—'a fruit not much unlike green walnuts in external appearance'—at Lucky Bay near Esperance in the Bight; and those of *Cycas media* not only gave Cook's midshipmen 'a hearty fit of vomiting,' but killed several of his pigs. A fair quantity of good arrowroot is obtained from them, and experiments have also been made for the production of a commercial starch and alcohol. A gum analogous to tragacanth is obtained from several species. *M. Hopei,* of northern Queensland, is the largest member of the genus. It is said to attain a height of 60 feet. *M. Fraseri* is peculiar to Western Australia. See BURRAWANG.

Cynometra, a widespread tropical genus of the family Leguminosae, consisting of trees or shrubs. The flowers are small, usually reddish in lateral clusters; leaves with one or two pairs of leaflets; pod semi-orbicular, fleshy and swollen. The wood of *C. ramiflora* yields a purple dye. In India the seeds are used medicinally in skin diseases, and the hard, coarse-grained wood is used for houses and native carts.

D

Dabchick, Little Grebe, or Black-throated Grebe (*Podiceps gularis*). See Grebes.

Daglish, Henry (1866-1920), born at Ballarat on 18 November 1866 and educated at Geelong, was in 1882 apprenticed to an engineering firm at Geelong, but in 1883 abandoned the trade for the Victorian public service. In 1895 he resigned, made an unsuccessful attempt to enter Victorian politics, and at the end of 1896 moved to Western Australia, joining the public service of that colony in January 1897. He resigned in 1901, and was elected from Subiaco to the State legislative assembly as a Labour member; in 1904-5 he was premier, heading Western Australia's first Labour ministry. He left the party, however, in 1905; in 1907-10 he was chairman of committees, and in 1910-11 minister for works in the first Wilson ministry. In 1912 he was appointed employers' representative in the arbitration court, and in 1914 was defeated at Subiaco and retired from politics. He died at Perth on 16 August 1920.

Dairying. The dairying industry in Australia was necessarily limited by the small local demand until improvement in the processes of refrigeration, towards the end of last century, made it possible for the farmers to develop an overseas trade. The Australian climate offered certain competitive advantages—e.g. except in a few localities stock can thrive in the open throughout the year, though practical experience has demonstrated the value of rugging the herd during the colder months and of providing tree-shelters—but the industry was handicapped by the poor breed of cattle, the intermittent droughts which led to irregular feeding, and the farmers' general ignorance of scientific methods. Since the eighties, therefore, efforts have been made by farmers, with the active co-operation of the State governments, to overcome these disadvantages. Stud cattle with good dairying qualities have been imported both by governments for State agricultural farms and by private individuals, and experiments in breeding have been made with the object of securing dairy stock suited to the Australian environment. As a result the average yield of milk has considerably increased, though it is still comparatively small, the 343 gallons per cow obtained in 1921 constituting a record for the Commonwealth. Special attention is paid to butter-producing qualities rather than to quantity, as it is the overseas butter-market that farmers hope especially to develop. Pasturage has also been improved by the eradication of herbage of little or no use and the planting of suitable grasses, though many indigenous varieties are excellent for stock and possess both milk-producing and fattening properties. To secure a regular food-supply more attention is being paid to the preparation of ensilage, as is necessary in a country subject to periods of drought. By a system of mixed farming it has been found possible to extend the industry to non-coastal and thinly-grassed districts, sufficient fodder being grown to carry the cattle through the winter months. The State agricultural departments send experts round the country to give practical demonstrations in approved methods of production; model dairies are also fitted up on most of the experimental farms; and advice is given through agricultural gazettes and special bulletins. Since the eighties there has also been a rapid improvement in the processes of manufacturing dairy products suitable for export, and butter, cheese, and preserved-milk factories have been established, usually on co-operative lines. As a rule the cream for butter factories is separated at the dairies, modern machines being used by most farmers. Generally speaking, the interests of consumers in the cleanliness and purity of dairy products have been safeguarded by the State and Commonwealth governments. It is not lawful to sell or offer for sale milk which is not fresh and wholesome or which has been adulterated in any way. Regulations provide for the supervision, by specially appointed inspectors, of dairy farms and herds, dairies and factories, all of which must maintain a prescribed standard. Dairymen, milk vendors, and factory proprietors are required under penalty to be registered. Every dairyman or milk vendor is required to report immediately when any person engaged at (or residing on) his premises has contracted any one of certain infectious diseases, in order that they may be effectively isolated. Any animal contracting a notifiable disease must be at once isolated, and the fact reported. The sale of milk from an infected cow is prohibited, and the inspector may order the animal to be destroyed. The foreign consumer is protected by Commonwealth regulations issued under the commerce act of 1905. All dairy products intended for export must be sent for inspection to appointed places, and an exact trade description must be permanently affixed thereto. The export of unsound, inferior, or abnormal dairy products is prohibited, unless the trade description applied to the goods includes the words 'below standard.'

As a result of this care and supervision the dairy industry in Australia has steadily developed since the eighties—except during the drought of 1914-16, when the herds were severely depleted. Most of the observations and conclusions embodied in the report of the Scottish agricultural commission (published in Edinburgh in 1911 under the title *Australia: its Land, Conditions and Prospects*) hold good for the present time, and constitute an excellent study of dairying conditions in the Commonwealth. But legislation passed by the Commonwealth parliament in 1924 creates new supervising authorities which are intended to standardize production in all the States. On these 'advisory boards' every section of the industry is represented as well as

the Commonwealth and State governments. The sphere of activity of each section is defined, and provision has been made for the adoption of a national brand, so that Australian dairy products may be recognized as such and accepted as of a given quality in the world's markets.

Historical Sketch.—Through the scarcity of cattle the first settlers were largely dependent on goats for their supply of milk. The government policy of maintaining a state herd and exchanging breeding cattle for the produce of the land was distinctly beneficial. About 1820 (according to Dr. Lang) cheese-making was introduced by George Rankin of Kelloshiel near Bathurst, and by 1836 large quantities of butter and cheese were being manufactured, and formed a considerable article of export, chiefly to Tasmania. The Hunter River soon gained distinction for its rich pastures. In 1826 the president of the local agricultural society referred to the need for exporting surplus dairy produce; nevertheless large quantities of butter were still imported from the Cape and Ireland in hermetically sealed vessels.

New South Wales.—For many years the Illawarra district was recognized as the most important dairying district of Australia; it was, indeed, so admirably adapted for dairying that the industry by degrees extended farther south to Ulladulla, Moruya, and Bega. Alexander Berry (q.v.) of Shoalhaven formed a good dairy herd, and in 1849 exported considerable quantities of butter to California. A fine race of dairy cattle, known as the Illawarra shorthorn, was evolved, probably from selective crossings of the Ayrshire with the milking shorthorn. During the fifties butter was sometimes sold wholesale at 2s. 6d. to 3s. per lb.; but the supply during the summer months exceeded the local demand, and prices would recede to perhaps 6d. per lb. The surplus was then exported to other colonies (chiefly Victoria); in 1853 79,990 lb., valued at £6636, was so disposed of. 'The progress of dairying from 1852 to 1883' says J. P. Dowling, 'was made under the old system, advances being made at Bodalla (south of Moruya) by the late Thomas Mort, and by Messrs. Fox, Tooth and Wren and other energetic settlers at Bega. In these districts were established factories furnished with all the best American cheese-making appliances, and the South Coast soon obtained a great and lasting reputation for cheese and bacon.' The introduction of cream separators at Mittagong by the Fresh Food and Ice Company in 1881, and of the co-operative factory system at Kiama in 1884, marked an epoch in the industry. Co-operation and herd-testing had been advocated for years by D. L. Dymock of Kiama, who instituted the *Herd-book.* He travelled widely, examining European and American systems of dairying, and brought to Australia the first Laval cream separator. The co-operative factory system gradually gained ground; in 1888 eight factories were at work, costing from £1500 to £2000 apiece and each taking milk from about 50 dairymen.

Hand-made butter, exported at this time in small quantities to London in the cool chambers of the Orient Company's steamers, realized 10½d. per lb., factory-made butter sent about the same time realizing 1s. This experiment led to a remarkable development of the industry. Butter was also exported to Queensland, Western Australia, Batavia, Calcutta, Bombay, Singapore, and Hong Kong. In 1891 the quantity of butter made under the old system was 10,484,474 lb., and of that made in butter factories only 8,049,656 lb.; but in 1900 the old system produced 4,216,134 lb. only, and the factories 18,817,747 lb. In 1891 there were 124 butter factories, to which milk was delivered, there being then no local separating creameries and no home separators; in 1900 there were 168 butter factories and 387 creameries.

Soon after 1888 there was a remarkable development of dairying in the subtropical Richmond River district. This district had been occupied chiefly by growers of sugar-cane, but a great fall in the price of sugar ruined many residents, and the government, when appealed to, suggested dairying as an alternative. The advice was acted upon; much of the country was cleared; dairy cattle were obtained, for the most part from the south coast districts, new settlers arrived, co-operative butter factories and creameries were established, and in a few years the largest butter factory in the world was in full swing at Byron Bay. A great deal of the region was covered with dense vegetation, but devoid of natural grasses. By 1913 there were 251,198 dairy cows in the north coast district, producing 107,462,642 gallons of milk, from which 43,650,510 lb. of butter and 401,677 lb. of cheese were made; 871,191 acres were under artificial grasses.

The introduction of small hand or power separators on farms proved extremely convenient for the farmers, who were saved the trouble and expense of conveying milk to the creameries or factories, and carting back to the farm skim milk for the pigs. Unfortunately, separation on the farms frequently resulted in the production of inferior butter; the cream, delivered at the factory only twice or thrice a week, was liable to become tainted, and one tainted can would affect a whole churning, for all creams were mixed together. To obviate this, the State's agricultural department urged legislation to compel the grading of cream at butter factories, and in 1915 the dairy industry act became law. Since that time a great improvement has taken place in the quality of cream delivered at butter factories, and a still greater improvement in the quality of butter placed before the public.

In 1902 steps were taken to provide instruction in dairy methods; a travelling dairy was equipped and sent about the country, and a well-equipped dairy provided instruction for students at the Hawkesbury Agricultural College, while similar instruction was given at the Wagga, Bathurst, Richmond River, Grafton, and other experimental farms. A stud farm was provided at Berry in the Illawarra district for dairy cattle of the best breeds obtainable in England, and an expert in cheese-making travelled through the dairying districts, giving instruction in the manufacture of high-class cheese. In New South Wales the industry is regulated mainly by the dairies' supervision act of 1901. Dairymen, milk vendors, and the proprietors of creameries and dairy factories must be registered. Inspections are made by 14 district inspectors under a chief dairy inspector. In 1922 fines to the amount of £2000 were imposed for adulteration of milk, lack of cleanliness, and similar offences. The figures for the period 1919-23 give an annual average as follows:—dairy cows, 766,802: milk, 241,458,721 gallons: butter, 80,436,192 lb.: cheese, 6,433,909 lb.: and condensed or concentrated milk, 9,578,227 lb.

Victoria.—In this colony also the industry received a new impetus towards the end of last century when improvement in the processes of

refrigeration made it possible to bid for a world-market. A royal commission on vegetable products in 1888 pointed out that Victorian farmers were, on the whole, slower than those of the Illawarra to adopt the new system of factory production with modern machinery, and recommended direct encouragement of the industry by bonuses for butter and cheese manufacture, and by establishing model dairies for instruction. Both recommendations were adopted; throughout the colony co-operative butter factories were established, and by 1892-3 the production of butter for export—which in 1889-90 only amounted to 828,882 lb.—had increased to 8,099,258 lb. The cheese industry was also developed, especially in the western district, and to a less extent in Gippsland; to encourage this branch of production the government obtained the services of an expert acquainted with Canadian methods. In 1890 a factory was established at Bacchus Marsh for the manufacture of preserved and concentrated milk on a commercial scale. By the end of the century the earlier shorthorn and Hereford cattle were gradually being replaced or crossed with Ayrshires, Jerseys, and other good dairy breeds; at the same time the process of cutting up large estates for dairying purposes was accelerated. The industry suffered severely during the drought of 1915-6, but development has been fairly continuous since that time. Acts which provide for the registration, inspection, and supervision of dairies, dairy farms, dairy produce, milk stores, milk vessels, dairy cattle, and grazing grounds are administered by the department of agriculture, though local authorities have the option of carrying out this duty within the limits of their jurisdiction; the department of health is also empowered to test foods, including dairy products, and to prosecute in cases of adulteration, etc. Under an act of 1922 the council of any metropolitan municipality (or a group of councils acting together) may establish depots at which milk may be bought, treated, and sold. In an area in which there is a municipal depot no milk may be sold unless it has been treated in a depot, or by approved methods in a factory. Provision is also made for the establishment of a laboratory of research in matters relating to milk. The figures for the period 1919-23 give an annual average as follows:—dairy cows, 689,507: milk, 223,977,333 gallons: butter, 73,123,728 lb.: cheese, 2,700,616 lb.: and condensed or concentrated milk, 43,382,932 lb.

Queensland.—In 1888, when the success of dairying in the southern colonies was assured, the government of Queensland obtained the services of a dairy expert, a well-equipped travelling dairy was procured, and instruction was given to farmers who desired to embark on the industry. At the time there were no more than half a dozen cream separators in the colony; of factories there were none worthy of the name, and it is doubtful whether a complete and properly equipped cheese-plant could have been found. From these small preliminary efforts an important industry was built up, and by 1895 the importation of butter and cheese had practically ceased. In 1888 the total amount of butter produced in the colony was 1½ million lb., and of cheese practically nothing; by 1894 the output of butter had trebled, and of cheese 1,536,997 lb. were made. The chief producing districts were Warwick, Brisbane, and Toowoomba. In 1895 was made the first experiment in exporting cool storage butter from Queensland, 7½ tons being shipped to London; by way of further encouragement to the dairy industry, a tax was levied upon owners of dairy cattle, and the proceeds were used for aiding the erection of butter and cheese factories, or for a bonus on these articles. In 1896-7 some 63 tons of butter were exported; the official report on that season's dairying states that the value of co-operation was becoming better understood, and it seemed likely that proprietary factories would sooner or later give place to co-operative factories. Next season the dairy expert reported that ordinary dairy cattle had increased in price at least 70 per cent during the year, and land that a few years before was practically unutilized, because unfit for agriculture, was carrying dairy herds. Steps had been taken to improve the herds, but the supply of well-bred cattle was still inadequate. In 1900 there were at work 53 butter and cheese factories and 146 creameries employing 595 persons. The output that year was 5875 tons of butter and 886 tons of cheese, valued altogether at £656,177; 620 tons of butter were exported. At that time dairy produce for England had to be shipped in intercolonial steamers to Sydney, and transferred there to oversea vessels.

The dairy produce act of 1905 revolutionized the industry. It provided not only for the inspection of dairies, dairy farms, and factories, but also for the appointment of grading inspectors to classify butter intended for export. In 1908 an amending act insisted that cream should be graded for manufacture into different qualities of butter, and no person was allowed to grade cream until he had obtained a certificate of proficiency. A year or two earlier the necessity for transhipping Queensland butter at Sydney had been avoided by inducing certain mail-steamers to call at Brisbane, the Queensland government paying a subsidy of £26,000 a year. The dairy produce act of 1920, which applies to the whole of the Queensland coast from Rockhampton southward, as well as to the Darling Downs and the districts of Maranoa, Mackay, and Cairns, is administered by the department of agriculture; under it in certain proclaimed areas the sale of milk is confined to persons licensed under an act of 1917, and is supervised by inspectors of the department of health.

A good deal of dairying is done on the share system (see AGRICULTURE). Owners of large estates and agricultural holdings cut them up into a number of small dairy farms run by experienced dairymen; the owners provide all necessary appointments (buildings, dairies, stock, implements, etc.), and profits are shared equally. This system prevails in the coastal area south of Brisbane. At Toogoolawah in the Brisbane valley a condensed-milk company has six model farms, comprising 4000 acres, 1200 acres of which are under cultivation for maize, lucerne, millet, and other grains. The figures for the period 1919-22 give an annual average as follows:—dairy cows, 484,918: milk, 115,407,061 gallons: butter, 45,418,420 lb.: cheese, 11,392,356 lb.: and condensed and concentrated milk, 11,825,766 lb.

Tasmania.—About 1858, according to M. H. Hull, butter and cheese were exported from this colony to the value of £16,000 per annum, the price of the butter being 2s. a pound. Ayrshire, Hereford, and Devon cows, bred with care, were used for dairy purposes. 'These animals,' said Hull, 'are taking the place of the cross between the bison and Brahmin cows which we used to have, and which had to be knocked down with a long pole and roped head and feet before they could be milked. It was at one time no unusual

thing for the milkman, after a turn of seven miles in the bush, to be tossed in the air by one cow and his shins kicked by another before he could succeed in inducing her to part with the usual pint of milk for the family's breakfast.' But the progress of dairying in the island—so eminently fitted for it by nature—has been inexplicably slow. As late as 1903 there were only 15 Tasmanian butter factories, producing less than a million lb. of butter, and the output of cheese was little more than half a million lb. The figures for the period 1919-22 give an annual average as follows:—dairy cows, 66,585: milk, 19,375,690 gallons: butter, 4,823,019 lb.: and cheese, 902,882 lb. The industry is supervised by local authorities, usually under by-laws drawn up by the department of public health; the same authorities are empowered to take samples of milk as a guard against adulteration.

South Australia.—Improved methods of dairying in this colony date from about 1885, when the colonial government began to assist the farmers by (*a*) supplying instruction in dairying methods and (*b*) facilitating the export of dairy produce. In 1890 the colony exported to England 10,850 lb. of butter, and in 1891 doubled the amount. By 1893-4 the production of butter was almost six million lb. and of cheese almost one million: three years later the approximate amounts were 9 million and 1¾ million; the peak was reached in 1910, when 10¾ million lb. of butter were produced—a figure not reached again until 1920. The industry is controlled throughout the State by the foods and drugs act of 1908, which is administered in the Adelaide area by the metropolitan county board and in the country by the board of health. The figures for the period 1919-23 give an annual average as follows:—dairy cows, 122,755: milk, 37,252,095 gallons: butter, 12,729,961 lb.: and cheese, 2,749,711 lb.

Western Australia.—An official report of 1891 recommended dairying as an industry that could be followed with advantage in the coastal area of Western Australia from the Moore River southwards as far as Cape Leeuwin and inland to the dividing range. But as late as 1911 the industry remained practically undeveloped, though during 1910 butter to the value of £342,771, preserved milk worth £78,492, and cheese worth £36,805 had to be imported. In June 1912 the chief inspector of stock reported that dairy cattle in the State had diminished by about 3000 head in one year. To encourage settlers to take an interest in dairying, the government then established a state farm at Brunswick, where pure Ayrshires are kept and bred. But the increase was small until 1916, when the dairy cows numbered 33,788, and a more rapid development followed. The public health authorities regulate the dairying industry in Western Australia, the premises of dairymen and milk vendors being registered and supervised by health inspectors; officers of the department of agriculture examine dairy herds at regular intervals, and apply the tuberculin test where disease is suspected. The figures for the period 1919-22 give an annual average as follows:—dairy cows, 50,732: milk, 10,775,631 gallons: butter, 2,404,318 lb. The production of cheese is insignificant.

Between 1912 and 1915 the number of dairy cattle decreased greatly; in 1915 it was only 1,684,393, with a milk production of less than 435 million gallons, and the 1912 standard was not regained until 1920. Apart from the increase in the production of condensed milk, due to the establishment in Australia of branches of several important European firms, the most noticeable feature of Australian dairying in recent years is the great increase in the average yield per cow. Before 1916 this was considerably under 300 gallons per annum; but more systematic breeding and herd-culling and the adoption of milk-testing systems in the more advanced States had by 1921 brought the average above 300 gallons in all States except Western Australia. For that year the average yield over the whole Commonwealth was 343 gallons, and in New South Wales and Victoria 363 and 366 gallons respectively. The world's record for milk-production—891b. per day for a year—is held by 'Melba XV,' a pure-bred shorthorn from Gundagai in New South Wales which from 14 June 1923 to 13 June 1924 produced 32,522½ lb. of milk, yielding 1614 lb. of butter-fat: her average test was 5 per cent.

For the Commonwealth as a whole the following statistics are interesting:

	1910	1920	1922
Dairy Cows	2,064,599	2,055,638	2,419,809
Milk (gallons)	572,998,277	623,285,221	685,309,582
Butter (lb.)	193,425,606	208,081,864	234,995,009
Cheese (lb.)	16,537,011	24,160,524	23,710,559
Concentrated and condensed milk (lb.)	12,491,261	70,944,482	51,460,739

W.S.C.

Daley, Victor James William Patrick (1858-1905), born at Navan in Ireland on 5 September 1858, lost his father in infancy, lived with his grandparents in county Armagh while a child, and when his mother married again was sent to school at Devonport in England. In 1874 he entered the employ of the Great Western Railway, but tired of it after three years and migrated to Australia, reaching Sydney early in 1878 and eventually finding work in Adelaide. Thence he drifted to Melbourne, became a free-lance journalist, and in 1881 returned to Sydney via Queanbeyan (where he had hoped to go gold-digging) and contributed to *Sydney Punch* and the then newly started *Bulletin.* In 1885 he went back to Melbourne, and for the next 13 years earned a precarious living by journalistic work, largely poetical; in 1898 a volume of verse by him, *At Dawn and Dusk,* was published in Sydney, and the New South Wales government was induced to give him a departmental clerkship; but he could not endure the routine, and disappeared from the office to resume his free-lancing. In 1902 his health failed, and friends arranged for him a voyage to the South Seas in 1903; in 1905 it was discovered that he suffered from tuberculosis, and on 29 December of that year he died at Waitara near Sydney. A second volume, *Wine and Roses,* was published posthumously in 1911.

Daley's work was unique in the Australian poetry of his time. The bush had little charm for him, except as a sunny and temporary refuge when city life grew too strenuous; and three-quarters of his verse might, as far as internal evidence goes, have been written anywhere in the world—except for the perpetual glow of sunlight through it. That, and the inspiration to seek romance in the present which vivifies his first book, were Australia's gifts to him; in the posthumous volume it has disappeared, to be replaced by a glamour of past romance that is purely Irish. Regarded simply as poetry, his work at its best is probably the best done in Australia.

Dalley, WILLIAM BEDE (1831-1888), born in Sydney in 1831 and educated at the Sydney College and at St. Mary's school—where he came under the influence of Dr. Polding—was trained for the law and called to the New South Wales bar in 1856 (Q.C., 1877). At the end of 1856 he entered politics, succeeding Henry Parkes as member for the city of Sydney in the first parliament under responsible government. In the second parliament (1858-9) he represented the Cumberland boroughs, and in the third Windsor, but resigned his seat on 25 February 1860. For three months (November 1858 to February 1859) he was solicitor-general in the second Cowper ministry. His eloquence marked him out as a valuable asset to his party, and he was one of the 21 new members whom John Robertson appointed to the legislative council in May 1861; but almost immediately Robertson offered him the post of commissioner of emigration, with Parkes as his fellow-commissioner. They reached England on 4 August, and at once began their work of stimulating voluntary migration, Dalley taking the home counties and Ireland as his sphere while Parkes toured Scotland and the west and north of England. In June 1862 Dalley resigned his post and returned to Sydney, but did not again take up politics seriously for many years, though he represented Carcoar from October 1862 to November 1864, and was a member of the legislative council from May 1870 to September 1873. In 1875 Robertson, then in the middle of his long struggle with Parkes, put Dalley back in the council and made him attorney-general in his third and fourth ministries (February 1875 to March 1877, August to December 1877); but for the next five years he again abandoned politics—resigning from the council in 1880—and it was only the coalition under Alexander Stuart, which ended the long rule of the Parkes-Robertson coalition, that persuaded him to reappear in the council and become Stuart's attorney-general on 5 January 1883. This time, however, his term of office was memorable. In October 1884 Stuart fell ill, and Dalley became acting premier. Early in 1885 the peril of Gordon at Khartoum was engaging the attention of the whole Empire. The news of Gordon's death—with its probable consequence, a Mahdist invasion of Egypt—stirred Australia profoundly; and Dalley, urged by a friend (Sir Edward Strickland) but with the zeal of an originator, offered Britain a contingent of infantry and artillery for service in the Sudan, and with all his eloquence roused New South Wales to raise and equip the necessary troops. The story of this 'Sudan contingent' is told elsewhere under that heading. The offer excited much enthusiasm in England (where it had been widely supposed that the Australian colonies were indifferent to Imperial affairs and almost ripe for secession), and Dalley gained renown as the first practical exponent of colonial loyalty; he was offered a knighthood, and could have had the chief-justiceship when Sir James Martin died in 1886, but refused both honours, and only under pressure consented in 1887 to be made a member of the privy council—the first Australian to receive that distinction. He died at Sydney on 28 October 1888.

Apart from the Sudan expedition, Dalley left no permanent mark on his times. He was, however, a great influence among his private friends (most of whom were publicists) for culture and tolerance and the adoption of world-standards rather than parochial. His eloquence as an orator was almost equalled by his facility as a writer; but neither faculty was put to its full use, and his fame will rest mainly on the one gesture by which he convinced not only Britain, but Australia, that the colonies too were British at heart.

Dalrymple, ALEXANDER (1737-1808), born near Edinburgh on 24 July 1737 and made a writer in the East India Company's service at the age of 15, took up his duties at Madras in May 1753 and a year or two later, having been noticed and favoured by Governor Pigot and Robert Orme the historian, was promoted to be deputy-secretary to the council. Developing ambitious plans for the extension of the Company's trade, he was allowed in 1759-62 to cruise in the Malay Archipelago, seeking new ports and privileges; he was thus present at the taking of Manila by an English fleet in October 1762, and discovered in the archives of that city a copy of the report made by Luis Vaez de Torres (see AUSTRALIA, DISCOVERY OF), on his voyage from the New Hebrides. Dalrymple at once saw that Torres had actually passed between New Guinea and New Holland through a strait which was marked in all recent maps as dry land; he therefore named the strait after its (unconscious) discoverer. Returning to England in 1765, he two years later published an *Account of Discoveries in the South Pacific Ocean before 1764*, which established his reputation as a geographer and induced ministers to nominate him as commander of the South Seas expedition of 1768; by demanding, however, that he should receive a commission as captain in the navy, which the admiralty flatly refused to give him, he lost the appointment—which was then given to James Cook. Hurt at the loss, and jealous of his supplanter, Dalrymple afterwards tried to belittle Cook's achievements by suggesting (without the slightest justification) that he had merely followed existing charts and had made no new discoveries. In 1775 he returned to Madras as a member of council, but after two years' service was recalled undeservedly, and in 1779 was made hydrographer to the East India Company. When in 1795 the admiralty created a hydrographic department, Dalrymple was made head of it; while well-informed, zealous and an excellent organizer, he was also indiscreetly arrogant, and in May 1808 was dismissed. This, the second great disappointment of his life, broke his heart, and he died on 19 June following. Besides the book already mentioned he published several books and pamphlets, the most important of which is his *Historical Collection of South Sea Voyages* (2 vols., 1770-1). Port Dalrymple at the mouth of the Tamar River in Tasmania was named after him by Governor Hunter in 1798.

Daly, SIR DOMINICK (1798-1868), born at Ardfry in county Galway, Ireland, on 11 August 1798 and educated at Oscott College near Birmingham, entered the colonial office; in 1822 he was made private secretary to Sir Francis Burton, lieutenant-governor of Quebec, and in 1825 assistant-secretary to the Quebec government. He served in Quebec until 1848, then returned to England, and in 1851 was made lieutenant-governor of Tobago and in 1854 of Prince Edward Island. In 1859 he resigned this post and went on leave, but in October 1861 was gazetted governor of South Australia. This appointment was made for special reasons. On the previous governor, Sir R. MacDonnell, had fallen the task of introducing responsible govern-

ment, and he had in the process involved himself in numerous disputes with his ministers and the legislature; his successor, therefore, must be both tactful and experienced in colonial government, and Daly—who had served in a subordinate position through the troubled times of Lord Durham's rule in Canada, and had been both an elected representative and a minister there under responsible government—seemed exactly suited for the position. He fulfilled expectations. Although during his term he was confronted with several awkward crises (notably the recalcitrance of Judge Boothby (q.v.), and the troubles incidental to the settling of the Northern Territory), he remained calm and impartial, loyal to his ministries—and there were ten of them in six years—but exercising a moderating and wise influence over all. Towards the end of his term his health failed, and he died in Adelaide on 19 February 1868. (Kt. Bach., 1856.)

Dampier, ALFRED (1847-1908), born in London on 28 February 1847 and educated at the Charterhouse, made his first appearance as an actor at Stratford-on-Avon, and subsequently travelled the English provinces. In 1872 he was engaged by H. R. Harwood to play in Melbourne, where he first appeared as Mephistopheles in his own version of *Faust*. For three years he played leading Shakespearian parts in Melbourne, and then returned to England via Sydney, Adelaide, New Zealand, and the United States. After a season at the Surrey Theatre he revisited Australia, leased a theatre in Melbourne, and produced in it (and in many other Australian and New Zealand towns) a series of Australian plays of which the most noteworthy was founded on Rolf Boldrewood's *Robbery Under Arms* (written in conjunction with Garnet Walch, q.v.). Two of his daughters, Lily and Rose Dampier, shared in his successes and were regarded as competent actresses. He did not confine himself to melodrama, but persistently interpolated Shakespearian revivals, and for many years was the only manager (except George Rignold) who kept the Australian public familiar with Shakespeare's plays. He died at Sydney on 23 May 1908.

Dampier, WILLIAM (1652-1715), born in 1652 at East Coker in Somerset, was intended by his parents for trade; but his father died in 1662 and his mother in 1668, and his guardian willingly let him follow his own inclinations. He was therefore 'removed from the Latin school to learn writing and arithmetic,' and within a year had shipped aboard a Weymouth merchantman for voyages to France and Newfoundland. Next he joined an East Indiaman for a voyage to Java, and early in 1673 shipped as able seaman in H.M.S. *Royal Prince* under Sir Edward Spragge, the most daring captain of the naval war with the Dutch. Invalided in August, and finding Spragge dead and the war over when he recovered, he accepted at the beginning of 1674 a post as sub-manager of a plantation in Jamaica; tiring of this after six months—for he was incurably a rover by disposition—he joined a Jamaica coast trading vessel, and in August 1675 sailed for Campeachy Bay in Yucatan and entered the logwood industry. The Bay was in Spanish territory and the trade forbidden, so that there was no long step from logwood-cutting to buccaneering, and Dampier was soon a buccaneer—but incidentally and as a means to extending his travels, not deliberately or for gain. He visited England in 1678-9, and on his return intended to take up logwood-cutting again, but was diverted to share in a trading expedition to the Mosquito Coast, and suddenly found himself in the thick of a buccaneer raid. From 1680 to 1682 he was a member of a daring gang which raided Portobello on the coast of Colombia, crossed the isthmus to Panama, failed in an attack on that town, seized a ship and coasted South America as far as the island of Juan Fernandez, and after attempting Arica and Coquimbo was forced to re-cross the isthmus by Indian paths under conditions of extreme danger. In 1682-3 Dampier spent an unhappy but comparatively restful 13 months in Virginia; then, impatient for more adventure, he joined another privateer (the *Revenge*, John Cook, master) bound for the west coast of South America via Cape Horn. On the way they captured a Danish vessel and used her to replace the *Revenge*, naming her *The Batchelor's Delight*, and in September 1684 they were joined by a certain Captain Swan in the *Cygnet*. Again the coast towns were raided and Spanish vessels captured as far north as Costa Rica; but no good leader showed himself, the buccaneers grew desperate with many failures, and in August 1685 Dampier joined Swan, who was eager to try new hunting grounds in the western Pacific. On 31 March 1686 the *Cygnet* left the Mexican coast to make for Guam in the Ladrones, reached the island with a half-starved crew, and on 21 June anchored off Mindanao in the Philippines; here the crew marooned Swan, and for another year cruised about the Malay seas—they touched at Tonquin and Cochin China, captured a few small Spanish vessels, and in the end decided to make south past Celebes and Timor to the vaguely known coast of New Holland.

The *Cygnet* sighted New Holland on 4 January 1688 in 16° 15′ S. lat. somewhere near the Lacepede Islands, and ran north along the coast to the entrance of King Sound, anchoring on the 5th in Cygnet Bay; here she was hove down and repaired, and Dampier resumed his usual pursuit of making the fullest possible notes about the country and its inhabitants. His description of the aborigines is well known: 'the miserablest people in the world. The Hodmadods of Monomatapa, though a nasty people, yet for wealth are gentlemen to these.' On 12 March the *Cygnet* sailed from King Sound by Christmas Island and the Sumatran coast to the Nicobars. There Dampier (who had long been tired of his companions) was marooned with two others—a few more deserting the vessel to join them—and the party bought a canoe and in spite of hurricanes managed to reach Sumatra; the *Cygnet* went off to Madagascar, and sank in St. Augustine's Bay. England was now Dampier's goal, which he attained by way of Tonquin, Acheen in northern Sumatra (1689), and Bencoolen in the south (1691), there boarding without leave a vessel (the *Defence*) bound for England and so, via the Cape of Good Hope, reaching home on 16 September 1691, three years after he left the *Cygnet* and eight after he started out.

In Bencoolen he had bought from a trader a certain 'painted prince' named Jeoly, a tattooed native of Mindanao, in the hope of making a living in England by exhibiting the curiosity; but he was compelled to sell the prince almost as soon as he arrived in London. For the next six years little is known about him except that during 1694 he was in Spain. In 1697 he brought out *A New Voyage Round the World*, dedicated

to Charles Montagu (afterwards earl of Halifax) the president of the Royal Society, and in the same year he was called as a witness in an enquiry about the proposed colonization of the Panama isthmus. The book stirred up two admiralty officials, Lord Orford and Lord Pembroke, to consider the possible advantages of a settlement in New Holland, which would lie on the flank of the Dutch Indies; and in 1698 Dampier was given the *Jolly* prize for an expedition to New Holland, New Guinea and the eastern Spice Islands. On his report that the prize-ship was quite unfit for the purpose he was given the *Roebuck* in exchange, and on 14 January 1699 sailed on his quest. The *Roebuck*, a vessel of 200 tons, was armed with 12 guns, manned with 50 men and boys, and commissioned in the navy, Dampier becoming a captain R.N.

He had intended to make his way out round Cape Horn and cross the Pacific in a latitude that would ensure his encountering some part of the still unknown east coast of New Holland. But the *Roebuck* was not in a condition to face the stormy seas of the Horn route, and its crew was cowardly and disinclined to run into bad weather unnecessarily. So Dampier took them south and east round the Cape of Good Hope, carefully avoiding on the way any port at which they might be tempted either to desert or to seize the ship. In the night of 1-2 August they struck soundings off the northern end of the Abrolhos group, and made north along the coast to an opening that Dampier named Shark's Bay, full of sharks, skates, and turtles, whose shores swarmed with iguanas and kangaroo-rats. Four days' search, however, produced no fresh water, and Dampier stood away north again past the archipelago named after him to Roebuck Bay, where on the 31st he at last came into contact with natives. But they were 'much the same blinking creatures' that he had seen 13 years earlier at King Sound; also there was no fresh water to be had, and scurvy was busy among the crew; so on 5 September he abandoned altogether further explorations on that coast, and made north for Timor, where he spent a restful three months among tropical surroundings. In December, having determined to investigate eastern Australia, he rounded the northern end of New Guinea, ran eastward from the Schoutens till he saw St. Matthias Island, skirted and rounded New Ireland under the impression that he was still on the New Guinea coast, and anchored in Montagu Harbour in New Britain: he had seen the 'Mother' rising from Blanche Bay, and the smoke from its minor craters, but was not attracted that way. Of the New Ireland and New Britain natives he saw a good deal, but could get nothing from them except coconuts and water, and had to procure pigs by armed force. Still coasting New Britain, in the evening of 24 March 1700 he sighted a very fine volcano, and was by it piloted through Dampier Strait: voyagers of to-day, however, will see no such sight, for Volcano Island has blown itself to pieces, diminishing in the last century from 2500 to 250 feet in height. The passage of the strait showed him that New Britain was really an island (he gave it its name) and the advent of the SE. trades made it a hazardous enterprise to push investigation farther south—or he might have passed New Guinea east-about and anticipated Cook; he let the trades take him back along the New Guinea coast, and on 26 April anchored off the western end of Ceram. Too little attention has been paid to Dampier's account of the New Britain group, which is very full and informative; his profile sketches of the coast, too, are useful to-day, and his observations on the natives are worth study by Australian administrators of the mandated islands.

On 3 July the *Roebuck* was in Batavia roads, characteristically asserting her dignity as a King's ship by demanding salutes from the Dutch authorities and from a British vessel at anchor there; but she was so ill-conditioned that on an overhaul the carpenter found her 'more leaky after he had caulk'd Her, then she was before,' and Dampier had to stay at Batavia until 17 October in order to make her fit for sea. She reached Cape Town on 30 December, St. Helena on 2 February 1701, and on the 23rd had to put in to Ascension Island with a leak too big to be stopped, even with slabs of the ship's beef. There she sank, with many of Dampier's books and papers; he and the crew came safe ashore, lived on the island till 3 April, and were then rescued and brought to England by H.M.S. *Anglesey* and the East Indiaman *Canterbury*.

Dampier's later life, though still adventurous and full of interest, was not concerned with Australian regions. His *Roebuck* voyage was disappointing to the admiralty, since it merely proved that New Holland would not serve their turn as an outpost against the Dutch; with his New Guinea and New Britain discoveries they were not concerned. Also, he had quarrelled with and somewhat bullied his second in command, a naval lieutenant of long standing, and a court martial decided that he could be no longer employed in the navy. Yet on 16 April 1703 he was again given a commission as captain to take two privateers into the South Seas. This was a fighting voyage, not one of discovery, and Dampier did nothing to his credit. One of his lieutenants was marooned and the other deserted; the mate of the second privateer (Alexander Selkirk by name, whose adventures were used by Defoe in his story of *Robinson Crusoe*) was marooned on Juan Fernandez, and Dampier ended the voyage as a prisoner in one of the Dutch East India settlements. He returned to England in 1707, found himself disliked and distrusted, and in August 1708 embarked as pilot aboard Woodes Rogers's privateer *The Duke*. This expedition had all the success the other lacked; rounding Cape Horn, it rescued Selkirk, raided the Spanish towns along the western coast of South America, captured a vessel carrying valuable cargo from Manila, crossed the Pacific to Batavia, and by way of Cape Town reached London again on 14 October 1711 with loot to the value of nearly £200,000. Dampier, however, profited nothing, for the prize-money was not distributed until 1719, and he died in London early in March 1715. Selkirk, it may be noted, was made second mate of *The Duke*, and was lieutenant in H.M.S. *Weymouth* when he died in 1723.

Dampier was a great man in his way, but his way was not that of command or of persistent endeavour. As a captain he failed again and again, both in tact and in discipline; as a seaman he was never more than one among the undistinguished crew. But as a close, accurate, and unwearying observer he was unequalled in his time, and possibly never surpassed. His charts and sketches are the best of their day, and some are still valuable; his drawings of birds and fishes are distinctly good; his writings are clear

and precise, and full of minor but nowadays specially interesting detail; his *Discourse of Winds* is spoken of by modern meteorologists as still a textbook worth study. He is best studied in his own writings, which in 1729 were published collectively (along with a few other narratives) by Knapton. Vol. i. is a reprint of his *New Voyage* (1697), vol. ii. contains his appendices on Indo-China and the Campeachy region and his *Discourse of Trade Winds, etc.* (1699); the *Voyage to New Holland, etc.* (1703) is in vol. iii., together with a *Description* of the isthmus of Panama by his shipmate Wafer (1702); in vol. iv. is Funnell's account of the privateering expedition of 1703-6, as well as four accounts of minor voyages. Dampier's reply to Funnell (who was a severe and not very competent critic of his work) was published in 1707, but is not included in the 1729 collection. It will be found at the end of John Masefield's edition of the *Voyages* (2 vols., 1906). There are also French and Dutch translations.

Dampiera, a genus of the family Goodeniaceae, consisting of herbs or shrubs mostly clothed with a heavy coat of cottony hairs, branched or star-shaped. Fifty-four species are endemic in Australia. The flowers are showy, purple, blue, white, or rarely yellow; calyx-lobes occasionally obsolete—when present they are small, often concealed under the hairy vestiture; corolla deeply slit in the upper part, but entire at the base; anthers cohering in a tube; fruit small, falling with the seeds still enclosed. In *D. Brownii* the hairs on the corolla are dark and plumed; *D. stricta* has angular branches and rust-coloured hairs on the flowers. Both favour the coastal sandstone.

Dangar, Henry (1798-1861), head of a notable New South Wales family, was born at St. Neot in Cornwall in 1798 and migrated to Sydney about the middle of 1821. He was at once appointed by Macquarie (at Oxley's request) assistant surveyor in the government service, and employed on field surveys. On 1 January 1826 he was sent to survey the area allotted to the Australian Agricultural Company at Port Stephens, and so came into contact with that company's officials. Consequently, when in 1827 Darling fell foul of him over his claim to some lands near Scone, and Dangar returned to England to protest against the governor's action, he was appointed surveyor to the company and returned to Sydney in that capacity at the end of 1829. In 1832 he settled finally at Neotsfield near Singleton, left the company's service in 1833, and sat as member for Northumberland in the old legislative council from 1845 to 1851. He died in 1861.

Of his sons, the second—Henry Carey Dangar—born at Port Stephens on 4 June 1830 and educated at the Sydney College and the university of Cambridge (M.A., 1857), was called to the bar in 1854, returned to New South Wales to take up a pastoral life, entered politics in 1874 as member for West Sydney, and was a member of parliament practically for the rest of his life (West Sydney, 1874-7; East Sydney, 1880-2; nominated to the legislative council, 1883). He died at Sydney on 25 April 1917. The third, Frederick Holkham Dangar, born at Port Stephens on 23 October 1831, preferred shipping to sheep-stations and founded the shipping firm of Dangar, Gedye & Co., which he managed until 1882. In that year he disposed of all his Australian interests and retired to London, where he died on 26 March 1921. He was especially interested in the training of officers for the British mercantile marine, and had a share in the well-known training-ships *Medway* and *Port Jackson*. Albert Augustus Dangar, the fifth of the brothers was probably the best-known of all. Born at Neotsfield on 8 June 1840 and at first inclined for sea service (he spent three of his boyhood years at sea), he was in 1858 placed on Gostwyck station near Armidale (which had been acquired by another brother, William Dangar, from E. G. Cory in 1834) to study stock-breeding, and in 1863 took charge of that and other properties as manager for the family. When the brothers divided the Dangar lands among themselves, A. A. Dangar took Mooki and another station, leased Gostwyck from a brother, and set himself to breeding merinos, long-woolled Devons, shorthorn cattle, and Suffolk Punch horses. Both as a breeder and as a business man he was uniformly successful, and, though never in politics, took a prominent part in public life; possibly he is most widely remembered (*a*) by the part he played as president of the Pastoralists' Union in the maritime strike of 1890, and (*b*) by his gift of £10,000 to a fund for providing a 'Dreadnought' battleship as a gift from Australia to Britain in 1909, which was afterwards diverted to the support of an immigration scheme for boys between 15 and 20. He also contributed largely to patriotic and other funds in connection with the South African war. He died at Baroona near Singleton on 5 April 1913.

Henry Dangar's brother Thomas settled in the twenties at Maitland, and about 1837 moved to Invermein near Scone. He was a member for the Upper Hunter from 1861 to 1864. His son, Thomas Gordon Gibbons Dangar, born at Sydney on 17 November 1829 and educated at the Sydney grammar school, settled in 1849 on the Namoi near Wee Waa, and from 1865 to 1880 sat in the assembly as member for the Gwydir, and for the Namoi (practically the same constituency under a new name) from 1880 till his death, with one slight intermission. He was a persistent advocate of a scheme for locking the Darling-Barwon river, and succeeded in having vessels brought up as far as Walgett. He died in Sydney on 4 July 1890.

Another family of Dangars, also Cornish but hailing from Bodmin and apparently quite unconnected with the family discussed above, was founded at Port Macquarie (moving later to Kempsey) by W. S. Dangar in 1834. The most notable member of this family was O. O. Dangar, born in 1842, who from 1889 to 1893 sat in the assembly for the Macleay.

Daphnandra, a genus of the family Monimiaceae, consisting of trees; the three species are endemic in Australia. *D. micrantha* (Satinwood) is a handsome tree of moderate size, extending from New South Wales to Queensland. It has a fragrant timber, used for packing-cases, but rather soft for most purposes. *D. repandula* is limited to Queensland. The bark has a transient bitter taste; infusions from it are rich in alkaloids and very poisonous, the action affecting the heart. The extract retards the development of septic germs, and will deodorize putrid meat.

Darley, Sir Frederick Matthew (1830-1910), born on 18 September 1830 in Dublin, and educated at the royal school of Dungannon and at Trinity College, Dublin (B.A., 1851),

was in January 1853 called to the Irish bar and went the Munster circuit. In 1861, when on circuit, he met Sir Alfred Stephen, who advised him to come to Australia. Leaving England in January 1862, he was admitted in June to the bar of New South Wales (Q.C., 1878). In September 1868 James Martin nominated him to the legislative council, of which he remained a member for 18 years; in November 1881 he succeeded John Robertson as vice-president of the executive council in the third Parkes ministry, and held office until the ministry was defeated in January 1883. Never a strong partisan, his most important political work was connected with the passage through the council of equity, divorce, companies, and criminal law amendment measures. In 1884 he and his brother-in-law Sir Peter Scratchley were appointed a commission to enquire into the defences of the colony. On the death of Sir James Martin in November 1886 Darley was offered the chief justiceship, but declined it; when Julian Salomons accepted and then resigned it, W. B. Dalley persuaded Darley to reconsider his refusal, and he was sworn in on 29 November. In 1891 he was made lieutenant-governor on the resignation of Sir Alfred Stephen, and in virtue of this appointment was five times acting-governor. In 1902, while on a visit to England, he was made a member of the South African war commission. He resigned his offices in 1909, went to England, and died there on 4 January 1910. (Kt. Bach., 1887; K.C.M.G., 1897; G.C.M.G., 1901; P.C., 1905.)

Darling, Sir Charles Henry (1809-1870), born in 1809 at Annapolis Royal in Nova Scotia and educated at the Royal Military College, Sandhurst, joined the army on 7 December 1826 (ensign, 1826; captain, 1839), and in 1827, coming to Australia with a detachment of his regiment (the 57th), was made assistant private secretary to his uncle Ralph Darling—then governor of New South Wales—becoming in 1830 his military secretary. When Governor Darling returned to England and the regiment was transferred to India, young Darling obtained permission to enter the senior department of the Royal Military College, and from there was appointed to the staff of Sir Lionel Smith, serving as his military secretary in the West Indies from 1833 to 1839. In 1841 he retired from the army to settle in Jamaica, and in 1843 was appointed director of immigration and adjutant-general of militia; he was also a member of the local legislative council, and in 1846-7 acted as secretary to the governor. In 1847 he was appointed lieutenant-governor of St. Lucia, and in 1851 lieutenant-governor of the Cape Colony to function during the absence of Sir George Cathcart on military duty in the eastern province. From May to December 1854, Cathcart having gone to command a division in the Crimean war, he administered the colony, and so presided at the incoming of parliamentary government. Before he actually left the Cape, he was nominated governor of Antigua and the Leeward Islands; this appointment he never took up, being sent on his return to England to administer Newfoundland, in which he inaugurated responsible government. From March 1855 to February 1857 he was governor of that colony; then he was promoted to the governorship of Jamaica, Honduras and the Bay Islands; and on 11 September 1863 he was transferred to be governor of Victoria. Here he was comparatively unsuccessful. Taught by two previous experiences that under modern conditions a governor must interfere as little as possible with the local politicians, he overdid non-interference and allowed the McCulloch ministry to tack a protectionist tariff on to the appropriation bill. The council, which under the constitution could not amend a money bill, rejected the whole bill again and again; a deadlock ensued, and to obtain funds for paying the public service and other government creditors McCulloch (q.v.) devised a scheme under which a bank lent the government money to pay its debts, then sued for the return of it, procured a judgment against the State, and was repaid under the governor's warrant. The council naturally protested, and petitions were sent to England against this autocratic procedure, but McCulloch dissolved the assembly and appealed to the electors, who sent him back with a much increased majority. Meanwhile duties under the rejected tariff had been and were collected, in spite of a supreme court judgment that they were illegal; and for allowing this and the other evasions of law Darling was sharply rebuked by the British government. His reply to the rebuke, including as it did a bitter attack on the personal character of certain councillors and a declaration that, if they were ever members of a ministry, he should receive their advice 'with doubt and distrust' compelled the British authorities to recall him. Cardwell in April 1866 made this decision, and it was confirmed by his immediate successor Lord Carnarvon. Darling's departure from Melbourne was characterized by exceptionally vivid demonstrations of popular sympathy, while the assembly in a parting address thanked him for having saved the colony from anarchy, and offered a gift of £20,000 to Lady Darling to compensate him for his enforced removal. Darling, of course, could not accept this without special permission from the colonial office. The assembly requested permission; Lord Carnarvon replied that it was impossible while Darling remained in the service; Darling thereupon resigned, and McCulloch 'tacked' the vote to an appropriation bill; the council rejected the whole bill, as before, and another election confirmed McCulloch's action. Then the British government again took a hand, directing the new governor (Sir J. H. Manners-Sutton, for whom see Canterbury, Viscount) not to allow tacking. McCulloch promptly resigned, the assembly refused to grant supply to his successor, and the governor had to recall him. Before his actual reappointment the problem had been otherwise solved. Darling, withdrawing his resignation, was granted by the British government a pension of £1000 a year from the date of his recall, and therefore intimated to the Victorians that the proposed gift was unnecessary. But when he died two years later (on 25 January 1870) the Victorian parliament unanimously voted a similar pension to his widow. (K.C.B., 1862.)

Darling, Joseph, born at Adelaide on 12 November 1870, came into prominence as a cricketer when at the age of 15 he made a score of 252 in a school match. On leaving school he took up farming, but in 1883 returned to Adelaide and in 1885 played with a South Australian fifteen that met the Australian team of 1886 (see Cricket). In 1893 he began to play for his colony, and from 1895 to 1906 was a member of every Australian team that went to England, captaining those of 1899, 1902, and

1905. He also took part in every test match played in Australia between December 1894 and January 1902, and in 1901-2 captained the Australians in the test matches at Sydney. Against Stoddart's English team of 1897-8 he scored three centuries in the five test matches. His highest score in test cricket was 178 (at Adelaide in January 1898), and his average for 55 innings 30.79. His scores in first class matches aggregate 10,723 runs, an average of 34.2. He is one of the greatest left-handed batsmen Australia has produced, and his 160 against England at Sydney in 1898 is probably one of the finest recorded exhibitions of hard hitting against great bowlers on a good wicket.

Darling, Sir Ralph (1775-1858), born in 1775 and in his early youth employed in the custom-house at Grenada in the West Indies, joined the army in 1793 (ensign, 1793; lieutenant, 1795; captain, 1796; major, 1800; lieutenant-colonel, 1801; colonel, 1810; major-general, 1813; lieutenant-general, 1825; general, 1841), and served in the West Indies—with one short interval—until 1802, taking part in the capture of Dutch Guiana and the Danish and Swedish islands. Returning to England in 1802 to take up an administrative appointment, he was sent to India with his regiment (the 69th) in 1805, but came back in 1806 and was a member of the staff at the horse guards until 1818. During these years he saw active service twice—with the 51st regiment under Sir John Moore in the expedition of 1808 that ended at Corunna (for which he received the gold medal), and in the Walcheron expedition of 1809. In 1818-23 he was in command of the British garrison in the Mauritius, and for the first 18 months of that term acted as governor, incurring much local displeasure by his success in putting down the slave-trade. This command ended his military service, which was distinguished for good staff work rather than for achievement in the field. Soon after his return to England he was invited to take over from Sir Thomas Brisbane the administration of New South Wales. With his accustomed thoroughness Darling spent the time that elapsed between his appointment and his departure from England in studying all available documents relating to New South Wales, and sent his private secretary, Henry Dumaresq (q.v.), in advance to collect local information on the conditions of the colony. Early in December 1825 Darling arrived in Hobart, proclaimed the separation of Tasmania from New South Wales, and instituted a separate administration under a lieutenant-governor. He then proceeded to Sydney. It was his intention to win respect for his administration by impartiality, and to align himself with neither of the existing political parties. Unfortunately for his purpose, he soon became involved in an acrimonious controversy with the independent press. There was considerable unrest in the colony. A group of native-born Australians led by W. C. Wentworth (q.v.), jealous of officials and 'exclusives' and eager for position and power, were demanding freer political and judicial institutions; to this end they were seeking the support of other discontented groups —emancipists, new settlers with small capital, soldiers, convicts, and any others who felt they had a grievance against the government.

The year 1826 was one of severe economic depression, following on a period of over-speculation in land and stock, and the general discontent was focussed by an untoward incident that enabled the local leaders, through the independent press, to direct a bitter attack against Darling. The troops had come to believe that a convict's life was preferable to that of a soldier, and on different occasions soldiers had deliberately committed crimes in order to be convicted. Darling, who from the beginning of his term had tightened the bonds of both military and convict discipline, considered this conduct a grave breach of military honour; when two soldiers—Sudds and Thompson by name—in 1826 committed larceny in order to be convicted and so dismissed from their regiment (which was under orders for India), he determined to make an example of them. He commuted their sentence of transportation to work with the road gangs, and ordered them to be publicly degraded and loaded with spiked iron collars. Gauged by the standards of the period, the punishment was probably not over-severe, but unfortunately Sudds died a few days after the public degradation. Immediately the disaffected politicians seized upon the incident, and Wardell (editor of the *Australian*) and Hall (of the *Monitor*) launched a bitter attack on the governor. He, resenting the personal attack, and no doubt fearful of growing disaffection among the convicts, decided to bring into force regulations for the control of the press which had been suggested to him by the colonial office before his departure from England. But his efforts to introduce a drastic licensing measure, and to impose stamp duties, were frustrated by Francis Forbes (q.v.), whose duty it was as chief justice to decide whether a proposed measure was repugnant to the laws of England. Forbes objected to both these measures as taking away the natural right of a British subject to free speech. Darling then attempted to control the independent press by a measure relating to seditious and blasphemous libels; but this, though it received Forbes's certificate, was disallowed by the colonial office. Darling was therefore thrown back upon a policy of prosecutions, and during 1829 the supreme court was principally occupied with libel actions that led to much ill-feeling between prominent individuals in the colony. Among other somewhat questionable methods intended to suppress adverse criticism, he attempted to withdraw convict servants assigned to the editors of opposition papers. The press, however, remained free, and E. S. Hall, who during the controversy had been frequently imprisoned for libel, was —with the assistance of Joseph Hume, a radical member of the British house of commons— largely instrumental in effecting Darling's recall.

Though the press controversy occupies so large a space in the history of Darling's administration, the very real political, judicial, and economic progress made in the colony during that period should not be ignored. Darling opposed the demands of Wentworth's party for a legislative assembly, as unsuited to the conditions of the colony; but he was prepared to advocate an enlarged council, initiation of legislation by its members, and election of the unofficial members. By an act of 1828 (for which see Constitutions) important advances were made towards political freedom. The unofficial membership of the council was increased; both the right of the governor (or king) in council to legislate against the wish of the council, and the virtual veto exercised by the chief justice over legislation, were greatly modified; private members were permitted to initiate mea-

sures, and the oath of secrecy was withdrawn. In addition to these constitutional changes the colonial office had already, by instructions issued in July 1827, changed the financial basis of the administration. A differentiation was in future to be made between expenditure incurred in the civil administration of the colony—which must be met out of colonial revenue—and that incurred in maintenance and control of the convicts, which would be met by the British treasury. During Darling's governorship, too, an approximation was made to modern judicial practice. The act of 1823 had provided for trial by jury in civil cases, when both parties concurred. Under the act of 1828 trial by jury could be granted by the court at its own discretion on the application of one party. Power was also given to the governor in council to extend the system of trial by jury in criminal cases. The first trial by a civil jury in the supreme court was allowed in 1830.

A radical change was also made in the system of land alienation. The activities of the Australian Agricultural Company in 1825-6 had led to a period of over-speculation that ended in a financial crisis. Darling created a land board to examine the claims of each applicant for land, to pick out *bona fide* settlers, and to allow them 640 acres for every £500 invested—a method that was strongly opposed by the poorer colonists. His proposal for a land pension scheme for loyal officials was rejected by the colonial office, but he was frequently accused of partiality in making land grants to his supporters. In 1831 the land grant system was abolished by instructions from London, and a minimum sale-price of 5s. per acre was fixed.

Darling was further responsible for many departmental reforms of material value to the colony. He facilitated inland communication by opening up good roads, substituted a department of customs for the old collection of import duties by a 'naval officer,' sanctioned the improvement of the water-supply for Sydney by Busby's bore (see BUSBY, JOHN), reorganized the post office and established an inland post, reformed the currency, and made arrangements for lighting the city streets. He deserves high praise, too, for encouraging the explorer Sturt (q.v.) in spite of the hostility of Mitchell, the surveyor-general. To his term are also credited the opening up of the Moreton Bay district by Patrick Logan, the discovery of the Darling Downs by Allan Cunningham, and the tracing of the Brisbane River to its head by Edmund Lockyer. While Darling was thus encouraging inland exploration, he was at the same time urging on the colonial office the necessity of laying claim to the whole of Australia, his commission giving him no control over the western coast; and in his time King George's Sound was occupied, and a settlement made at Swan River.

Darling's best service to the colony was his reorganization of the administrative departments, though he spoiled much of his work by too close attention to detail. But he was never popular; Forbes undermined the confidence of the British government in his capacity; charges were continually made against him by disaffected colonists; and with the fall of the Tory government in 1830 his recall was inevitable, and came in March 1831.

After his return to London his time was occupied in replying to his numerous critics, and in preparing his defence before a select committee of the house of commons which was appointed in 1835 to investigate the charges of misgovernment made against him. By this committee he was acquitted of blame in the Sudds-Thompson affair, and no evidence was given in support of other charges. William IV was thus able to confer a knighthood on him in recognition of his long service, but he was not again employed. He died at Brighton on 2 April 1858. (G.C.H., 1836.)

Darling Lily. See AMARYLLIDACEAE.

Darling Pea, popular name of several species of *Swainsona*. This is a genus of the family Leguminosae, consisting of herbs which, with the exception of one New Zealand species are endemic in Australia. The plants have fern-like leaves, showy blue or pink to reddish pea-shaped flowers, and thin, inflated pods. Sheep which habitually eat these herbs separate from the flock, wander listlessly about, eventually reach a stage of delirium and frequently injure themselves by jumping over imaginary obstacles. The most dangerous species are *S. Greyana, S. luteola, S. galegifolia,* and *S. coronillifolia.*

Darter or **Snake-bird,** a large aquatic bird (*Anhinga novae-hollandiae*) the only Australian representative of the family Anhingidae. Other members of the genus are found in the warmer parts of America, Africa, and southern

Darter.

Asia. The Australian darter frequents rivers and swamps throughout the continent, and is also found in New Guinea. In general appearance it resembles its relatives the cormorants, but has a very long, slender neck which, when the body is submerged while swimming, resembles a snake rising from the water; hence the name 'snake-bird,' often applied to it. The anatomy of the neck is remarkable, the lower vertebrae being set irregularly and the corresponding muscles specialized. When swimming beneath the water, the bird keeps its neck bent until it comes within striking distance of a fish; then the neck is suddenly straightened by the action of the specialized muscles, and the fish impaled on the sharp bill.

Darters are comparatively rare birds in southern Australia, but on some occasions considerable numbers appear in districts where they are not generally seen. They are sociable, and breed in colonies, constructing nests of sticks in trees growing in swamps. W.B A.

Darts, fishes belonging to the widely distributed genus *Trachinotus*; several occur on the tropical coasts of Australia, and some extend southwards in warm currents. They resemble their allies the trevallies (Carangidae) in general form, but are covered with distinct and brilliant silver scales. They are very swift swimmers, and their vertical fins are produced into acute lobes, on account of which they are also known as swallow-tails. One species (*Trachinotus anak*) may attain a length of four feet; it is very destructive to oyster beds, moving over them in schools of 50 to 100 individuals, and devouring large quantities of the shell-fish. It has no teeth in the jaws, but its throat is provided with powerful crushing plates. A.R.McC.

Darvall, Sir John Bayley (1814-1883), born in Yorkshire in 1814, educated at Eton and Cambridge (B.A., 1833; M.A., 1837), and called to the bar from the Middle Temple in 1838, migrated the next year to New South Wales to practise his profession in Sydney. Entering local politics, he was in 1844 nominated to the legislative council, but in 1848 resigned the nominee position and was elected to the council first by Bathurst (1848-51) and then by Cumberland (1851-6). Consistently with that resignation, he opposed Wentworth's scheme for a constitution because it included a non-elective upper house. After the introduction of responsible government he was returned to the new assembly by the North Riding of Cumberland (1856-7), the Hawkesbury (1859-60), East Maitland (1863-4), and West Sydney (1864-5) accepting nomination to the council during the interval 1861-3. He was solicitor-general in the Donaldson ministry of 1856, and held the same office and that of attorney-general in the Parker ministry of 1856-7. Sir George Reid eulogizes his 'accomplished wit, which could reach heights of graceful eloquence and depths of abusive satire with equal facility and finish.' In 1850 he was appointed a senator of the university of Sydney, and in 1851 refused the offer of a judgeship in Victoria. In 1865 he abandoned politics, returning two years later to England, where he died on 28 December 1883. (C.M.G., 1869; K.C.M.G., 1877.)

Darwinia, a genus of the family Myrtaceae, consisting of heath-like shrubs with small opposite or scattered leaves. The genus is endemic in Australia, 18 out of 23 species being confined to Western Australia. The flowers are small, white, or greenish; calyx-tube cylindrical, bell-shaped, or hemispherical, 5- (rarely 10-) ribbed; petals 5, entire; stamens 10, alternating with staminodia, and shortly united at the base in a ring. Several species contain a highly perfumed volatile oil; but there is considerable difficulty in their propagation, as they rarely produce perfect seeds.

Daucus, a widely distributed genus of the family Umbelliferae, consisting of herbs. *D. carota* is the culinary carrot. *D. brachiatus* (Native Carrot), a slender herb found in all the States, is a useful stand-by to the western pastoralist, its deep tap-root enabling it to withstand drought. Sheep are very fond of it, and thrive wonderfully on it where it is plentiful; in dry periods the hungry ones scrape the roots out of the ground with their hoofs. The bristly fruits, locally known as carrot burrs, are slightly injurious to wool.

Davenport, Sir Samuel, (1818-1906), born at Shirburn in Oxfordshire on 5 March 1818, in 1842 migrated to South Australia and, with his brother Robert, was the first to farm land in the Macclesfield district, where another brother (George Francis) had purchased a 'special survey' in 1839. The fluctuations incidental to pastoral life induced him in 1845 to cross the Murray and take up land near Beachport on Rivoli Bay, of which district also he was a pioneer. In May 1846 Colonel Robe nominated him to a seat in the legislative council, but he opposed Robe's policy both on mineral royalties and on state aid to religion, and had to resign. In 1855, however, Sir R. G. MacDonnell again nominated him, but he resigned in August 1856, and in March 1857 was elected to the new council, retaining the seat until August 1866. During 1857 he was commissioner of public works in the Finnis (March to August) and Torrens (September) ministries. Politics, however, was not his chief interest; his real value to the colony was as a developer of its resources. He pioneered settlement not only at Macclesfield and Rivoli Bay but in the north and north-east also. In 1859 he accompanied Warburton in his explorations between Streaky Bay and Lake Gairdner. At Beaumont in the hills above Adelaide he grew vines and olives, and encouraged the growth of mulberry trees for silkworm culture. He was frequently chosen to represent his colony at international exhibitions, among them the London of 1861, Philadelphia of 1876, Sydney of 1879, Melbourne of 1880, and Colonial and Indian (in London) in 1886. He was the first president of the South Australian branch of the Royal Geographical Society, as well as president for 7 years of the local agricultural society, and for 15 years of the Adelaide chamber of manufactures. He died on 3 September 1906. (Kt. Bach., 1884; K.C.M.G., 1886.)

Davey, Thomas, of whose youth nothing is known except that he was a protégé of Lord Sandwich and that his father was a personal friend of the first Lord Harrowby, obtained a commission in the marines in 1778 (2nd lieutenant, 1778; 1st lieutenant, 1780; captain-lieutenant and captain, 1795; major, 1809; lieutenant-colonel in army, 1812, colonel—local for New South Wales—1813; on half-pay, 1814), and on 30 November 1786 volunteered for service in the guard intended to accompany Phillip to Australia. No sooner, however, had he discovered the nature of the settlement than he applied for relief at the expiration of three years, as he was entitled to do under his original agreement; and in December 1792 he returned to England, reverted to the main body of the marine corps, and served at Trafalgar. In 1810, news of the death of Colonel Collins having reached London, Davey applied for the vacant lieutenant-governorship of the Derwent settlement, and brought the Harrowby influence to bear; consequently, when in 1811 it was decided to bring the whole island under a single lieutenant-governor, Davey was appointed—partly, it would appear, in order that from his much increased pay he might be able to refund to the corps the large amount by which his accounts as paymaster were short. Bathurst warned Macquarie privately that his financial honesty was doubtful—fair evidence that the appointment had been made by influence outside the colonial office; and Macquarie in 1817, when Davey was recalled, wrote openly that 'it would have saved a great deal of Money to the Crown, had Government given a Pension of Two or Three Hundred per Annum

to Colonel Davey, instead of sending him out as Lieutenant-Governor.'

Though his commission was dated 1 September 1811, he did not leave England until 4 June 1812, and stayed in Sydney for nearly four months after his arrival there on 25 October. Macquarie was unfavourably impressed by him; he seemed honest and well-meaning, but was dissipated, volatile, and easily imposed on; still for a year or two his public conduct was 'pretty correct.' In 1815, however, his profligacy and drunkenness had begun to affect the public service (among other charges is one that he had connived at the smuggling of spirits), and Macquarie urged his recall. Davey stoutly denied the charges, and bombarded Harrowby with detailed attempts at refutation and counter-charges that involved both Macquarie and his own successor Sorell. The general situation, however, was too clear to admit of condonation, whether or no any particular charge was untrue; private profligacy, wrote Bathurst, could not be overlooked in the officer commanding a reformatory, and Davey must go—though 'in the way least hurtful to his Feelings and to those of his Family.' Accordingly on 27 November 1816 Macquarie notified him of his recall and offered him an additional grant of land in Tasmania as compensation; Davey considered the offer insufficient, and after handing over the colony to Sorell on 9 April 1817 went to Sydney and for a year fought hard to get the grant increased and transferred to the mainland. He then returned to Tasmania, tried to farm his grants and failed, and on 11 May 1821 left Hobart for Sydney and England. About the same time his land-grants were finally settled at 4000 acres in Tasmania (including 200 at Newtown, close to Hobart) and 2000 in the Illawarra district of New South Wales. He died in England on 2 May 1823.

The actual value of Davey's work in Tasmania is much disputed, and the usual view is that he was an uncouth ruffian of whom the colony was well rid. This is most unjust to him. His private life is indisputably beyond excuse. His official landing in the colony—'the weather being warm, he carried his coat on his arm'—may have been undignified. But his administration of public affairs was on the whole marked by common sense; he threw open the port of Hobart and encouraged farming, thus providing the settlement with two wide avenues to prosperity; he did as much building as his limited labour supply would allow; and his proclamation of martial law throughout Tasmania on 25 April 1815, though illegal and repudiated in severe language by Macquarie, was the one measure taken against the bushranging gangs of the time that really checked them.

David, Sir Tannatt William Edgeworth, born on 28 January 1858 at St. Fagans near Cardiff in Wales, and educated at Magdalen College school and New College, Oxford (B.A., 1880; Hon. D.Sc., 1911; Hon. D.Sc., Manchester, 1919), in 1882 proceeded to New South Wales to take up an appointment as assistant geological surveyor in government employ. In 1883 he surveyed the tin-fields of the New England district, and in 1886 the coal-bearing strata of the lower Hunter valley; during this work he discovered the hitherto unsuspected existence of important coal-seams west and south of Maitland, and a large area there was reserved by the government for coal-mining and subsequently became the great Maitland field (see Coal). In May 1891 he was made professor of geology and physical geography in the university of Sydney. He at once became a leader in the scientific world of Australia, was elected in 1896 to the presidency of the Royal Society of New South Wales, in the same year joined the coral research committee of the Royal Society of London, and in 1897 led an expedition to Funafuti in the Ellice group to superintend the putting down of a bore to ascertain the actual structure of coral reefs. This bore, which was carried to a depth of 1114 feet, confirmed the theory of Charles Darwin about reef-formation. In 1899 he was awarded the Bigsby medal by the Geological Society of London. In 1900 he was elected a fellow of the Royal Society of London. In 1898-1905 Professor David devoted himself to his university duties indefatigably, employing any spare time in the investigation of evidence for a glacial period in Australia. For this and similar work the Australasian Association for the Advancement of Science in 1909 gave him the Mueller medal. In 1906 he explored for geological purposes the Deccan (India) tableland at the head of the Godaveri River, and, after attending the international geological congress in Mexico as a delegate from Australia, investigated the effects of the San Francisco earthquake. Towards the end of 1907 he joined the Shackleton expedition to the Antarctic (see Antarctica), intending merely to accompany it to South Victoria Land and return with the *Nimrod*; but on arrival at the base he decided to see the enterprise through, and became the unquestioned leader in its scientific work. He led the climbing party in the first ascent of Mount Erebus, and another to ascertain the exact site of the south magnetic pole, which he reached on 16 January 1909. In 1914 he was awarded by the Geographical Society of France the Maltebrun medal, for work done in collaboration with R. E. Priestley on the geology of Antarctica, and in 1915 received the Wollaston medal from the Geological Society of London.

About the middle of 1915 the Australian government decided to send a mining corps to the front, and David energetically aided in recruiting and organizing it, accompanying it in February 1916 as major in charge of the technical headquarters staff. When in May the corps reached Hazebrouck, it was reorganized as three separate companies, and David was absorbed into general headquarters as chief geologist to the British army, supervising the practical application of geological knowledge to tunnelling, water-supply, and the locating of deep dug-outs throughout the British sphere of operations. He held this position till the war ended, winning the D.S.O. in 1918, and returning in May 1919 to New South Wales to resume his work at the university. In 1917 the Royal Society of New South Wales awarded him the Clarke medal, and in 1924 he was elected a corresponding member of the Geological Society of the U.S.A., and in the same year resigned his professorship and retired on a pension, devoting himself thenceforth to research work. In 1925 he was elected an honorary member of the Geological Society of Belgium, and a foreign member of the Royal Bohemian Science Society of Prague. (C.M.G., 1910; K.B.E., 1920.)

Daviesia. See Leguminosae.

Davis, Henry Charles (1815-1854), born at Usk in Monmouthshire on 18 May 1815, edu-

cated at Downside and ordained priest on 8 November 1840, was for some years prefect and —since he had fine musical taste—precentor of Downside, and afterwards missioner in charge of the parochial district surrounding the college. On 24 September 1847 he was by papal brief appointed to the bishopric of East Maitland in New South Wales, the intention being that he should act as coadjutor to Archbishop Polding in Sydney—and in fact he never visited the town from which he took his title. He was consecrated in August 1848, and arrived in Sydney on 8 December, taking up at once his duties as coadjutor—which were concerned especially with the educational and business administration of the diocese—and adding to them the particular care of church music. He almost rivalled Dr. Polding himself in inspiring the admiration and love of his co-religionists. Further, his zeal for and skill in education won for him the close friendship of Dr. Woolley, the Anglican principal of the university of Sydney, of which Dr. Davis was a senator from 1850 to 1854. His health, however, never good, gradually grew worse during his life in Sydney, and he died on 17 May 1854.

E. M. O'B.

Dawes, WILLIAM, son of an admiralty official at Portsmouth, joined the royal marines as a second lieutenant in 1779, and seems to have very soon distinguished himself as a scientific observer and astronomer. When in 1786 it was decided to send an expedition to New South Wales, Dawes (then stationed at Portsmouth) volunteered for the service, and Dr. Maskelyne (the astronomer royal) recommended that he be put in charge of the observations of a comet which was expected to be first seen in southern latitudes during 1788. Ross's detachment of marines being complete, Dawes was attached to the marines in the *Sirius*, but in July 1788 was transferred by Ross to the marine force on guard duty in place of William Collins. About this time he was building on Dawes Point—which he called Point Maskelyne—the first observatory in Australia (see ASTRONOMY), and it remained in his charge until his departure; Maskelyne in 1791 gave it a transit instrument. Dawes also acted as engineer officer, designing defences for the port, a service for which he had been specially recommended by Lord Grenville, then home secretary. In December 1789 he led an exploring expedition across the Nepean (which had just been discovered by Tench) to a hill which he named Mount Twiss—probably the ridge beyond Linden; like the other Blue Mountain explorers of those days, he spent most of his time in descending precipices and climbing up the opposite cliffs, instead of keeping on the ridge, as the Blaxland party did in 1813. Another expedition in August 1790, with Tench and Hill, merely tangled him up in the rough country along the Warragamba. In 1788 he had applied for leave to remain three years in the colony, and in 1791 would have taken advantage of Grenville's recommendation and prolonged his stay, but for an unfortunate quarrel with Phillip. In December 1790 Phillip ordered out a search party to hunt down an aboriginal who had wounded his convict gamekeeper, and either capture or kill six others as a warning. Dawes at first refused to take part in such an expedition, but after a consultation with Richard Johnson, the chaplain, reconciled his conscience to the duty. On returning, however, he told Phillip he was very sorry for having gone, and would never undertake such work again. This naturally angered the governor, who regarded it as a reflection on his humanity; Dawes refused point-blank to withdraw what he had said, and it became impossible for him to serve longer in the colony. At the end of 1791, therefore, he returned to England, with the intention of revisiting New South Wales and settling there as a farmer and teacher of aborigines. William Wilberforce, however, intercepted him and procured him the governorship of Sierra Leone. Two years' hard work there (1792-4) so impaired his health that he could no longer perform his official duties, and Wilberforce tried to get him another appointment in Australia, preferably as superintendent of schools; but Dawes preferred to try West Africa again, and even sacrificed his half-pay to do so. He came back from Sierra Leone in 1796, and then disappeared into private life—so that Hunter in 1798, needing an engineer, had to suggest that 'if Mr. Dawes could be found' he would suit very well. In 1799 he was a witness before a house of lords committee on the slave trade, and in 1800 went for the third time to Sierra Leone, but was back in England by 1807. His later career is unknown in detail; he settled in the West Indies, and it was believed for many years that he died at Grenada on 14 April 1819—at which date a Lieutenant Dawes, R.N., did die there. But in the Mitchell Library at Sydney there is a memorial addressed by him to the colonial office from Antigua on 1 December 1826, recounting his services and applying for back pay that Phillip had promised him.

Dawes was an exceptional man for his time. His scientific ardour—Mrs. Macarthur notes that 'he is so much engaged with the stars that to mortal eyes he is not always visible'—and his humanitarian principles, which in New South Wales drove him to technical mutiny and in Sierra Leone undermined his health, were qualities uncommon among soldiers (or even private people) of the early settlement. His name is commemorated in Dawes Point, Port Jackson, the site of his observatory and of his first defence works.

Dawson, ANDREW (1863-1910), usually known as Anderson Dawson, was born at Rockhampton in Queensland on 16 July 1863, received but a meagre education, and was in turn grocer, mining prospector, and amalgamator. He was the organizer and first president of the miners' union of Charters Towers, and in 1893 was returned by that constituency to the Queensland legislative assembly. Being an effective debater, he soon became prominent in the parliamentary Labour party, and on 1 December 1899 formed the first Labour ministry that held office in Queensland—or in Australia; it was notable as including Andrew Fisher and William Kidston, but lasted only till the 6th of the month. In 1901 Dawson was elected to the federal parliament as one of the six senators from Queensland; he was minister of defence in the Watson ministry from April to August 1904, was defeated at the election of 1906, retired from politics, and died at Brisbane on 20 July 1910. Though his name is given as Anderson Dawson in parliamentary returns the registers of his birth and death show that his Christian name was Andrew.

Deakin, ALFRED (1856-1919), born on 3 August 1856 and educated at the Melbourne grammar school and the university of Melbourne, was called to the Victorian bar in 1877, but almost immediately abandoned his profession for journalism and politics. He joined the staff of

the *Age* and the *Leader*, establishing a firm friendship with David Syme, who in 1879 recommended him to the electors of West Bourke. In the next 18 months he fought four elections for this constituency, winning the first against Robert Harper, losing the next two, and in July 1880 heading the poll. He represented it uninterruptedly until 1889; on its subdivision in that year he was returned for Essendon, and retained that seat until, in 1900, he left State for Federal politics. Entering the Victorian parliament as a supporter of Graham Berry, his eloquence so marked him out that in 1883 Berry took him into the Service-Berry coalition of that year, and when those two leaders retired in 1886 the coalition was maintained under Gillies and Deakin for another four years. His main interest during this period was the use of irrigation to extend settlement north of the main divide. In 1884 he was made chairman of a commission on the subject, and in 1885 visited the United States and Mexico to study irrigation methods; in California he met the Chaffey brothers (q.v.), and from this meeting originated the settlement at Mildura. Soon after his alliance with Gillies his report took practical shape in an irrigation act, followed by several water-supply acts, which gave the State control over all sources of water-supply, authorized the construction of 'head works' (reservoirs, etc.) out of public funds, and permitted the formation of district irrigation trusts to which money might be advanced for the construction of channels and other agencies of distribution. Here, unfortunately, Deakin's one serious defect as a politician intervened to produce something like a disaster. He retained to the end of his life the underlying belief that all men were as highminded and scrupulous as himself, and that precautions against dishonesty or wilful negligence were unnecessary. Consequently no certain provision was made against the carelessness or maladministration of the water trusts, and in a few years the government found itself saddled with a large number of bad debts, and was compelled to write off much of the money it had advanced. Nevertheless Deakin's policy, though extremely costly, was of great benefit to Victoria, and has enabled that State to employ usefully an exceptionally large proportion of its area.

In 1887 Deakin was chosen (with Service, Berry and Lorimer) to represent the colony at the London conference of that year. His oratory and culture made a great impression on English public men, and his candid criticism of the colonial office and the British prime minister (Lord Salisbury) set a much-needed example to other Australian delegates, and for the first time asserted the position of the self-governing colonies as integral parts of the Empire rather than dependencies of the mother-country. Before returning to Australia he visited Italy and Egypt, and studied the irrigation methods of those countries. In 1890 the Gillies ministry after several reconstructions was defeated, and the *Age* commissioned Deakin to visit India and study irrigation there; this tour resulted in the publication of *Irrigated India* (London, 1893) and *Temple and Tomb in India* (Melbourne, 1893).

Meanwhile he had thrown himself heart and soul into a new movement. On 9 July 1889 Henry Parkes suggested to Duncan Gillies that the federal council—which had been created in 1885 by four colonies only—should be superseded by 'a federal parliament and executive with complete authority, upon the lines of the Dominion of Canada.' Gillies resented what seemed to him to be a slur upon the existing council, and only Deakin's tact prevented a flat refusal to consider the proposals. After much talk, however, a conference of colonial ministers met in Melbourne on 6 February 1890, Gillies and Deakin representing Victoria, and Deakin made the first of many great speeches advocating early and unfettered federation. To the convention of 1891 he went as a non-ministerial representative of his colony, took an active part in the debates, and was a member of the constitutional committee, though not of the sub-committee that actually drafted the constitution. When the convention's bill fell through, he returned to the bar, refusing all offers of office in Victoria, and confining his parliamentary work mainly to the chairmanship of the committee of accounts. In 1897 the federal movement was revived, and a convention of colonial representatives had to be popularly elected: Deakin came third on the Victorian list, and was again put on the constitutional committee; and, as before, though he took an active part in debate, his name is not connected with any important clause or section of the constitution. It was outside the convention, rather, in tactful conversations with recalcitrant members, that his work for federation was done; just as it was outside parliament, by an opportune speech during the 1898 meeting of the Australian Natives' Association, that he did most to carry federation in Victoria.

When in 1899 the constitution was adopted by majorities in five colonies, Deakin at once emerged into prominence as a statesman. The arduous campaign had won him the close friendship of Edmund Barton, and for the next four years they worked together. Their first task was to procure the acceptance of the bill by the British ministry and parliament, and in March 1900 Barton, Deakin, Kingston, Dickson, and Fysh began a series of conferences with Joseph Chamberlain, then secretary for the colonies. These are narrated under FEDERATION. The next task was to form a ministry capable of inaugurating the federal administration, and after an unpleasant interlude (caused by the governor-general's offer of the prime-ministership to Sir William Lyne, q.v.) Barton and Deakin collected round them the most prominent men of the six federating colonies. The next three years, while he was Barton's attorney-general, were probably the happiest of Deakin's life. He was a valuable adviser and a good administrator, but unhappy when he himself had to make big decisions; as long as that task was Barton's, he could go about his work unworried and in high spirits. It was during that time that he gradually formulated the principles which were to guide Australian policy at least up to 1914; the financial relations between the Commonwealth and the States, the concentration of immigration activities in federal hands, the creation of an Australian squadron, the scheme of industrial arbitration by a federal court, and many minor developments of Commonwealth activities, were devised and roughed out by him, although most of them were brought into actual being by other leaders.

In 1903 Barton, glad to leave active politics and disturbed by the resignation of Kingston and the disfavour with which his naval policy was regarded, retired to the high court bench and left to Deakin the burden of the prime-ministership. Confronted at once with the impatience of the Labour party and the sullen resistance of the official opposition, he lost ground at the elections

of December 1903, and was defeated by a combination of his opponents on a proposal to bring State business activities under the jurisdiction of the federal arbitration court (which he opposed). A few months later he aided George Reid to oust the Labour ministry that had succeeded his own, and gave Reid's ministry a passive support until May 1905. Then a speech in which he warned Reid that his support might eventually be withdrawn was taken for an immediate notice to quit, and after weeks of political turmoil he emerged again as prime minister with a small following of his own and a promise of steady support from Labour. This arrangement lasted for more than three years, during which a really protectionist tariff (with provision for preference to Britain) was established, the restrictions on alien immigration were somewhat modified, old age pensions were instituted, and a series of commercial laws (affecting copyright, trademarks, trusts, secret commissions, etc.) was passed; a beginning was also made with the military defence scheme, and negotiations were initiated with the admiralty concerning a local naval defence scheme. In 1907 Deakin visited England to take part in the colonial conference of that year, and toured the country after the conference was over in the interests of mutual fiscal preference. This exceptionally heavy strain on his physical powers brought about a collapse that was in the end to remove him altogether from public life.

Towards the end of 1908 the Labour party, which had been growing restive, withdrew its support, wrecked the ministry, and substituted one of its own under Andrew Fisher. After much hesitation Deakin decided to join the former freetraders (whose fiscal beliefs had gradually been dropped or put aside), and formed with Joseph Cook the notable 'Fusion' of 1909. In this coalition, too, Deakin's ideas were dominant, and in the year of its existence the Fusion managed to create—though in an imperfect form—the compulsory military training system, conclude with the admiralty an arrangement for the creation of the Australian squadron, and institute the high commissionership. Its existence, however, was purely a matter of parliamentary bargaining, and at the elections of 1910 it was severely defeated. The Labour ministry (Fisher's second) which then came into power set itself to carry out in full most of the measures that Deakin had for years advocated or designed, and his position as nominal leader of the opposition was much weakened by the fact that his own speeches could be quoted against him for nearly every ministerial proposal. His health, too, was failing rapidly; gradually he withdrew himself from parliament and in January 1913 left politics altogether. At the beginning of the war he served on a royal commission on foodstuffs, and at the end of 1914 was made Commonwealth commissioner to the Pan-Pacific exhibition at San Francisco; but neither rest nor travel could restore his strength, and after a long illness he died at Melbourne on 7 October 1919.

It would be difficult to exaggerate the debt which the young Commonwealth owes to Alfred Deakin; yet the bulk of Australians has probably no knowledge of it, and many prominent men (usually non-Victorians) would assert that such influence as he had was malign. The truth is that he had too telescopic a vision to see clearly what was under his feet. With his eyes fixed on the future, on the Australia that might be built up by the measures he devised, he could not see how narrow and petty were the objects of many who supported him. He had no sense of party leadership or of partisanship; he was probably the only Australian politician who ever told the electors 'Whether you vote Yes or No, provided you vote as Australians, we shall not have anything to complain of.' Thinking too far forward, he was rarely in a hurry; if opponents remained unconvinced, he would rather give them time to change their opinions than force them to yield to his majority. Consequently his political career is a succession of coalitions with men who only half understood him and had little sympathy with his aims. Possibly the best analysis of his character will be found in an anonymous article published in the *Quarterly Review* in 1911, which speaks of 'on the one hand, his personal charm, his self-forgetfulness, his high purpose, his clear distant vision; on the other, his intense dislike to compulsion, his mental remoteness, his failure to understand how arguments and acts that appeal to him will strike other people.' Apart from local politics, he was certainly the most polished orator Australia ever heard, the most widely-read and philosophic of her citizens, and the most sincere and effective advocate of her development as an important and responsible unit within the British Empire.

See Walter Murdoch's *Alfred Deakin: a Sketch.*

Deane, Henry (1847-1924), born at Clapham near London on 26 March 1847 and educated at Queen's College, Galway, and King's College, London, was employed on railway engineering works at first for the London metropolitan railways, then in Hungary, and later in the Philippine Islands. In 1880 he joined the railway service of New South Wales and rose to be engineer-in-chief; the introduction of steam tramways in Sydney and Newcastle, and the building of the Hawkesbury railway bridge (see Roads and Bridges), were undertaken during his term of office. In 1906 he retired from the New South Wales service, but in 1908 was made by the Commonwealth authorities controlling engineer of the survey for the transcontinental (Kalgoorlie to Port Augusta) railway, and in 1910 became engineer-in-chief in charge of the Commonwealth railway construction branch. For four years he organized and equipped the staff that was building the great railway, but retired in 1914, when about 200 miles had actually been constructed. He afterwards practised in Melbourne as a consulting engineer, and died there on 12 March 1924. He was an ardent botanist and a leading member of the Linnean Society of New South Wales, and was associated with J. H. Maiden (q.v.) in a good deal of work on the genus *Eucalyptus.*

Defence. See Military Defence, Naval Defence.

Demoiselles, members of the family Pomacentridae, all of small size, but so common and so brilliantly coloured that they are among the best-known fishes of the tropics. Most observers of life on coral reefs recall tiny fishes of vivid blue and orange, like living gems, that flash in and out of the maze of coral branches. These are demoiselles of the genera *Glyphisodon, Pomacentrus, Chromis,* etc., swimming either in small schools or singly. A striking black-and-white species, *Dascyllus aruanus,* is very common on the Great Barrier Reef of Queensland, where it so habitually associates with madrepores that it may be collected by the simple process of lifting the coral stock from the water with the fish

entangled among its branches. If the fish be again liberated in water where there is no coral, they become bewildered without their host, swim helplessly round one another, and can be readily recaptured by hand. Another species of *Chromis*, opalescent green in colour, also finds safety and shelter among the branches of madrepores, while various gaudily tinted species of *Amphiprion* are only found hiding among the tentacles of giant sea-anemones. These anemones are provided with myriads of stinging cells with which they capture and kill their prey, and if touched ever so lightly, cast forth innumerable poisoned darts. Yet *Amphiprion* swims freely among the tentacles without injury, even its naked eyes suffering no harm; and the anemone, ordinarily so sensitive that it retracts at the slightest touch, is unaffected by the movements of the demoiselles even when they penetrate into its open mouth.

A few representatives of the family occur in southern waters, and some, such as the White-ear (*Parma microlepis*) of Sydney fishermen and the Sailor-fish (*P. polylepis*) of Lord Howe Island, are remarkable for their extraordinary changes in colour and marking during growth.

A.R.McC.

Dendrobium. See ORCHIDACEAE.

Deniehy, DANIEL HENRY (1828-1865), born in Sydney on 16 August 1828 and educated at first at the Sydney College, was taken to England by his parents at the age of 14 and placed in charge of a tutor to be prepared for entrance into Cambridge. Wearying of study, and well supplied by his father (who had returned to Sydney) with money, young Deniehy after a few months went off to visit relatives in Ireland, met and liked the leading members of the Young Ireland party, and then made a tour of the principal picture-galleries of Europe. Returning to Sydney, he was articled to Nicol Stenhouse (q.v.) and allowed to study literature in his excellently equipped library; on 3 May 1851 he was admitted to practice as an attorney. His interests, however, were too wide to allow him much success in a profession which demands close and perpetual attention. In 1853 he delivered a course of lectures on modern literature at the Sydney school of arts; in 1854 he entered political life at a meeting of protest against Wentworth's constitutional proposals, being entrusted with a resolution condemning the proposal to institute an Australian titled nobility. In 1856, finding that his Sydney practice was not increasing, he settled in Goulburn, where he immediately made himself prominent as a politician and on 13 February 1857 was returned to the assembly for Argyle; this seat he held until 11 April 1859, and from May to November 1860 represented East Macquarie. Although his term in parliament was made notable by his co-operation with T. A. Murray and John Robertson in forcing the principle of free selection into Charles Cowper's land bill, yet he failed in politics, as in law, to make himself a permanent position. W. B. Dalley, a close friend of his youth, describes him as too uncompromising, too irritable, and too careless of the feelings of others to understand how his bitter sarcasm, indiscriminately employed, must alienate his best friends. During these years, however, he was at the height of his fame as a speaker; incapable of maintaining a continuous hold on any party or working harmoniously with any colleague, he was yet in constant request as an orator, and his brilliant invective was listened to with profound and admiring attention. But his influence on public life in the colony was exercised chiefly through the *Southern Cross*, a journal which he helped to found in 1859 and edited for the year of its existence. His contributions included both political and literary criticism, and made it the ablest Australian journal of its time. Usually dealing with matters of local and temporary interest, and couched in the half-dignified and allusive style popular among the men of his day, these articles do not produce on modern readers a tithe of the effect they had when published; but 'How I Became Attorney-General of New Barataria,' for instance, was considered at the time not only the most brilliant political satire written in Australia but one of the most brilliant in the English language. At the dissolution of 1860 he retired from politics and in 1862 settled in Melbourne as editor of the *Victorian*, a paper recently established by Charles Gavan Duffy; ill-health, and a habit of drunkenness which the sense of his own failure and the death of his eldest and best-loved son brought upon him, drove him back to Sydney, to desperate poverty, and at times to something near madness. Utterly broken down, he left Sydney for Bathurst in September 1865, and died there on 22 October.

Deniehy's reputation must always rest rather on what his contemporaries thought of him than on any lasting value in his published work. But his contemporaries were practically unanimous. Nicol Stenhouse spoke of him as 'the brightest spirit who has yet moved among us;' R. H. Horne praised his wide intellectual sympathies, his ready wit and genuine eloquence, his keen and subtle knowledge of men and things; W. B. Dalley called him 'the most brilliant of the native-born . . . an unrivalled orator by nature as well as by careful cultivation.'

Denison, SIR WILLIAM THOMAS (1804-1871), was born in London on 3 May 1804, educated privately and at Eton and in February 1819 entered the Royal Military Academy. In 1823 he passed for the royal engineers and in 1826 received his commission (lieutenant, 1826; captain, 1841; major, 1854; lieutenant-colonel, 1855; brevet-colonel, 1857; colonel, 1860; major-general, 1868; lieutenant-general, 1871). From 1827 to 1831 he was employed in Canada on the construction of the Rideau canal, and for a report on American timbers was made an associate of the Institute of Civil Engineers, and awarded the Telford medal. In February 1833 he became instructor of engineer cadets at Chatham, where he established an observatory, and in 1836 was employed as an observer at Greenwich observatory. In 1837 he was put in charge of works at Woolwich dockyard, and was employed by the admiralty until June 1846. About this time it was thought necessary to appoint an engineer officer to the governorship of Tasmania, and Sir John Burgoyne recommended Denison, who was appointed and reached Hobart on 26 January 1847. His main task was to be the reorganization of convict labour so as to provide sufficient work for all; but a large proportion of the colonists was vehemently agitating against any further importation of convicts, and six members of the council had resigned as a protest against the autocratic action of Denison's predecessor, Sir John Eardley-Wilmot (q.v.), in connection with convict expenditure. Denison's first duty was to settle this quarrel; he had power to make a selection from among the six ex-councillors and their replacers, but the matter soon became entangled in

legal technicalities, and the governor in despair dismissed the whole council until the British law officers unravelled the tangle. Thus during 1847 Tasmania was governed without a council, and only in 1848 was it announced that the Queen had reinstated the original six.

Before this puzzle was solved Denison was involved in several disputes with the supreme court. The judges had declared certain taxing acts illegal; Denison said they had not done so in time, more than 14 days having elapsed since the acts were passed. During the controversy over this point he suspended one of the judges for using his position to escape payment of a debt; this action was approved by the colonial secretary, but Denison's attempts to override the supreme court's decision about the taxing acts were disallowed. His general conduct of business, however, was commended, and he was asked to make recommendations for providing Tasmania with an elective legislature. His strong representations in favour of a two-chambered legislature, 'to check the development of the democratic spirit,' had great weight with Earl Grey when he was devising representative institutions for all the colonies in 1848-9. Hard worker as he was, and a diligent promoter of education, charity, public works, and defences, Denison was never popular in Tasmania, mainly because he disliked the proposal to abolish transportation. To reward him, therefore, for good service and at the same time to remove him from an unfriendly atmosphere, he was appointed on 20 January 1855 governor of New South Wales and (nominally) governor-general of the Australian colonies—a title which he managed to have cancelled before the end of his first year of office. In New South Wales he was far less his own master than he had been in Tasmania, but found on his hands the much more difficult task of accustoming impatient colonists to administer a 'responsible' system of government. In 1860 he complained that he had had five sets of official advisers in 3½ years, and not a single satisfactory piece of legislation from the five. His personal influence was mainly directed towards securing a sound public works system and efficient defences, and his plans for the protection of Port Jackson are commemorated in the name of an island fort in the centre of the harbour. His controversy with Charles Cowper in 1860 over the Tawell grant is narrated under Tawell, John. He was a zealous patron of music and the arts and sciences and at both Hobart and Sydney used his official residence as a meeting-place for artists and their admirers. From New South Wales (which he left on 22 January 1861) he was transferred to the governorship of Madras, where his personal ability and special skill in engineering and military affairs had fuller scope. His suggestions for reorganizing the Indian army were adopted by an army commission, though not by the British government; he encouraged irrigation works, and advocated more and cheaper railways; he strongly opposed the admission of Indians to the public service and the local councils, holding that the mass of natives did not desire to participate in the government—which is doubtless true. From 21 December 1863 to 12 January 1864 Denison acted as governor-general of India. He left Madras in March 1866, and spent the rest of his life in England, acting from 1868 onwards as chairman of a commission on river-pollution; in 1870 he published a series of reminiscences of his career under the title *Varieties of Vice-regal Life*, and died at East Sheen on 19 January 1871. (Kt. Bach., 1846; K.C.B., 1856.)

Dermaptera. See Earwigs.

De Rougemont, Louis. See Grien, Henri.

Derris, a genus of the family Leguminosae, consisting of tall woody climbers, chiefly tropical. The flowers are yellowish, white, or rarely violet, in small clusters along the flower stem; pod bordered by a narrow wing; leaves with numerous leaflets. The bark of *D. scandens*, a handsome climber, yields a coarse fibre. The pounded leaves of *D. uliginosa* are used to stupefy fish. In India its stems are used as ropes.

Derwent Jackass. See Butcher-birds.

Desert-bird. See Warblers.

Desert Lemon. See Atalantia.

Devil-fishes or **Diamond-fishes,** rays of the family Mobulidae, some of which are the largest of their kind, attaining a width of over 20 feet. The disk is expanded laterally into two angular wings, producing a somewhat diamond-shaped body from which is derived the vernacular name under which these huge rays are known in Queensland. They are sometimes observed in schools of eight or ten, surrounding a shoal of small fish; they raise the ends of their pointed pectoral fins to beat the water with resounding splashes, and thereby scare their prey into a huddled mass, so that it can be readily swept into their capacious mouths by means of a pair of arm-like lobes projecting forward on each side of the head. The capture of devil-fishes with harpoons provides exciting sport and a little danger. When harpooned, a large individual will tow a small launch behind it at a great speed until it becomes tired out, but may then be hauled alongside and despatched. Sometimes, however, the fish turns upon its enemy, throws itself clear of the water, and casts its whole weight upon the boat, which is either smashed or swamped. These fish are not uncommon on the coast of Queensland, and stray individuals occasionally wander as far southward as Port Jackson.

A.R.McC.

Devil's Twine. See Cassytha.

Dewfish. See Jewfish.

Diamond-birds or **Pardalotes,** a genus (*Pardalotus*) of small perching birds, peculiar to Australia and Tasmania, generally placed in the family of flower-peckers (Dicaeidae), but sometimes regarded as constituting the separate family Pardalotidae.

Diamond-birds are brightly coloured, active little birds, generally seen in small parties searching foliage for the small insects on which they feed. Their notes are loud but rather monotonous, owing to their constant repetition and limited vocabulary. They construct beautiful domed nests of grass (or strips of bark) in a hole—either at the end of a narrow tunnel which they excavate in a bank, or in a natural hollow in a tree, the site depending on the species. It is remarkable that they can construct such elaborate nests in almost complete darkness. They lay four or five white eggs. In most species the sexes are similar.

The Spotted Diamond-bird (*P. punctatus*) is perhaps the commonest species throughout southern Australia and Tasmania. It is black and buff, with patches of red and yellow, spotted

with white and buff. Its note resembles the words 'sleep, baby.' It excavates a very long, narrow tunnel in a bank, at the end of which its

Striped Diamond-bird.

nest is placed in a chamber. The Striped Diamond-bird (*P. striatus*) is another common form, with a similar range. It has commonly been divided into three species, known as the red-tipped, orange-tipped, and yellow-tipped pardalotes—the names referring to the coloration of the tips of the small feathers on the wing at the base of the quills. The number of quill-feathers striped with white also varies. The exact status of these three forms is still not properly understood; all three have been found in south-eastern Australia, to which the orange-tipped bird appears to be restricted, the yellow-tipped extending to Tasmania and the red-tipped to Western Australia. Probably it is a case of trimorphism within a single species. In notes and habits they seem to be entirely similar, the call may be represented by the word 'wittychu,' a name by which the bird is sometimes known locally. The nest is built in a hole in a tree.

The Forty-spotted Diamond-bird (*P. quadragintus*), peculiar to Tasmania and King Island, is another of the species which nest in tree-holes. The Black-headed Pardalote (*P. melanocephalus*), of southern Queensland and northern New South Wales, excavates a tunnel in the ground. Its note resembles the words 'chip-chip,' and it is often known locally by this name. The two other species are chiefly found in the northern parts of the continent.

W.B.A.

Diamond-fishes. See DEVIL-FIHSES OR DIAMOND-FISHES.

Diamonds were first discovered in Australia by E. H. Hargraves (q.v.) near Guyong in New South Wales, late in June 1851. During the next ten years others were found in the Macquarie and several of its tributaries, but no industry was started until in 1867 a deposit of some size was discovered in the Cudgegong valley about 19 miles north-west of Mudgee. This deposit was worked for a short time, but the value of the stones recovered did not cover the heavy expenses, and a flood in 1870 destroyed practically all the plant. In 1867 diamonds were also found near Bingara, in the hills west of Inverell, and subsequent discoveries on various tributaries of the Gwydir River have produced most of the stones recorded from New South Wales. At Oakey Creek near Barraba diamonds have been found in situ in a dolerite dyke. At Mittagong diamonds were found in 1890, in clay at the bottom of a pebble drift (possibly the old channel of the Nepean River), but attempts to open a mine there were frustrated by inrushes of water. The working of the industry has been very spasmodic: during the nineties of last century, for instance, production ranged from less than 500 carats in 1892 to nearly 26,000 carats in 1899. At the present time (1925) the yield in this State is still mainly derived from the Inverell-Tingha district: it amounted in 1922 (no later figures are available) to 1000 carats valued at £1300, the total production up to that date being estimated at 201,000 carats valued at £143,000. In Victoria diamonds of small size have been found in the beds of streams running through granite country in the Beechworth district, at Kongbool in the Western district, and near Benalla. In 1912 a few small stones were found in the sluice-boxes of the Great Southern alluvial mine at Rutherglen. A few have also been found near Pilbara in Western Australia, in the Donaldson district of Tasmania, and on the Echunga goldfields in South Australia; one stone from the Echunga district was sold for £70. The yield of diamonds in the States other than New South Wales is too small to be included in the official returns. The New South Wales diamond is distinguished by its exceptional hardness.

Diamond Trevally. See PENNANT-FISHES.

Dianella, a genus of the family Liliaceae, consisting of perennial herbs—chiefly Australian, but extending to a few areas in tropical Asia, Oceania, and New Zealand. The flowers are blue, nodding, in loose sprays; fruit an ornamental blue berry; roots fibrous, often shortly creeping, the plants forming dense tufts. The fibre of *D. laevis*, which is strong and of a silky texture, was used by the aborigines for making baskets. *D. tasmanica* is mentioned in Curtis's *Botanical Magazine* as a greenhouse plant from Tasmania, whose great beauty consists of an abundance of bright blue berries; a spray is depicted in a coloured illustration. Summer visitors to Mount Kosciusko may see gorgeous masses of this lovely flower in favourable situations.

Dibbs, SIR GEORGE RICHARD (1834-1904), born in Upper Fort-street, Sydney, on 12 October 1834 and educated at St. Philip's Church of England school and the Australian College, at 22 commenced life as commission agent and wharfinger with one of his brothers, the firm being known for years as J. C. Dibbs & Co. In 1865 he settled in Valparaiso as a corn factor, and during his two years' residence there twice successfully ran the Spanish blockade with cargoes of flour and wheat. The failure of the Agra Bank drove him back to Sydney, where he resumed his old calling, extending it in 1869 to include shipowning and importing. In 1874 he entered public life as an advocate of republicanism, free-trade, and free and compulsory primary education, and on 16 December in that year was elected

to the assembly by the highly democratic constituency of West Sydney. He was not re-elected at the 1877 elections, but on 5 December 1882 was returned for St. Leonards, and on 7 January 1883 took office as treasurer in the Stuart ministry. In January 1885 he effected an improvement in public finance by withdrawing the government account from the Bank of New South Wales (which had monopolized it) and distributing it among the leading banks, which associated themselves for the purpose. During Stuart's absence in England (1884-5) Dibbs actively assisted Dalley (q.v.) in despatching the Sudan contingent to Egypt. In October 1885 Stuart resigned, and Dibbs formed his first ministry: Parkes ousted him from the St. Leonards seat, but he obtained one in the country constituency of Murrumbidgee, and for not quite three months held the premiership. After an interlude of two months during which Sir John Robertson was premier, Sir Patrick Jennings formed a ministry that lasted nearly a year (February 1886-January 1887), in which Dibbs was colonial secretary; this was a coalition ministry, and Dibbs, now more than halfway towards protection, was believed to be dragging his colleagues with him. After a stormy existence, during which customs duties were considerably increased, the Jennings ministry was displaced by Sir Henry Parkes and Dibbs went into opposition. In January 1889, owing to dissensions within the Parkes party, he formed his second ministry, and went to the country on the fiscal issue. Defeated, he gave place to Parkes, whose fifth ministry after 2½ years was ousted in October 1891 by the action of the just-formed Labour party. Dibbs thereupon returned to office at the head of an avowedly protectionist ministry, carried through a protectionist tariff, and during a visit to England in 1892 strengthened the financial position of several Australasian colonies (for he represented Victoria, South Australia, Tasmania and New Zealand as well as New South Wales) and gained the reward—he had long since abandoned republicanism—of a knighthood conferred directly by Queen Victoria. On his return he took part in a remarkable triangular parliamentary duel, three votes of censure on him being moved in a single sitting of 26 hours and 87 speeches; the first was defeated by 30 votes, the second by 62, and the third by 4. During the financial crisis of 1893, when bank after bank closed its doors, the prompt action of the Dibbs government—inspired by T. A. Dibbs (for whom see below), and R. J. Black—stemmed the panic and restored confidence by declaring notes issued by local banks to be legal tender, and in other ways giving the banks and the public breathing time. At the elections of 1894, which were fought on the fiscal question, Dibbs was severely defeated and resigned, and in the elections of the following year lost his seat and retired from politics. In 1896 he was appointed managing trustee of the government savings bank of New South Wales, and held that position until his death, which occurred on 4 August 1904.

Dibbs is chiefly remembered as the bitter opponent of Henry Parkes in his later career and as the successful champion of a protectionist policy for New South Wales. His early republicanism faded away in the course of time, as did that of many contemporaries; it was in reality the expression of a widespread opinion that in the seventies and eighties England interfered with Australia but did not help her, and died out when it became clear that the Imperial connection was essential for defence; and Dibbs, who was greatly interested in defence questions and was for 50 years a member of the volunteer forces, saw the dangers attaching to independence as soon as he began to consider world politics. His attitude towards federation was peculiar. In 1884 he moved a resolution that would have committed New South Wales to join the federal council, but was defeated by one vote. Denounced in 1880 by Henry Parkes as a pronounced opponent of the movement, he declared that he favoured it—provided that it took the shape of unification coupled with separation from the Empire. In spite of this, parliament chose him as a delegate to the preliminary conference of 1890 and to the convention of the following year. He served on the judiciary committee of the latter body, but took little part in the general proceedings, though he proposed that Sydney should be made capital of the Federation. In 1894, however, when a new federal league with proposals for the election of the next convention by the people was reviving the federal movement, Dibbs (then premier of New South Wales) put forward a scheme for the unification of New South Wales and Victoria, leaving the other colonies to come in later if they so desired—a proposal excellent in theory, but one which would have defeated its own object because no sparsely-populated colony would have allowed itself to be absorbed into one which already held 71 per cent of the people of Australia. (K.C.M.G., 1892.)

His brother, Sir Thomas Allwright Dibbs (1832-1923), born in Sydney on 31 October 1832 and educated at the Australian College, on 7 July 1847 entered the employ of the Commercial Banking Company of Sydney, in which he remained for the whole of his working life. Twenty years later he was made general manager of the bank, and for 48 years greatly influenced in that capacity the financial career of New South Wales; though less prominent in public life than his politician brother, he probably made a more permanent mark on colonial affairs. As the address presented to him on his retirement emphasized, he not only built up on sound foundations the prosperity of his bank, but 'by an enlightened policy contributed much to the rapid growth of industries and the development of the State's resources,' and was in a special manner the financial adviser of nearly every New South Wales ministry from the eighties up to 1915. In July of that year he retired from active work, but remained a director of the bank. He took a keen interest in all movements that could help soldiers, especially wounded soldiers, and gave his house and estate known as Graythwaite on the heights of North Sydney as a home for disabled men. He died on 18 March 1923. (Kt. Bach., 1917.)

Dibbs, Sir T. A. See Dibbs, G. R.

Dickinson, Sir John Nodes (1806-1882), born in the West Indian island of Grenada in 1806 and educated at Fulham and Cambridge (B.A., 1829; M.A., 1832), studied law at the Inner Temple and was called to the bar in 1840. In 1844 he was appointed a judge of the New South Wales supreme court, and for nearly 14 years worked as a colleague of Sir A. Stephen and Sir R. Therry; in 1860-1 he acted as chief justice during Sir A. Stephen's absence on leave. From May 1856 to April 1858 he was a member of the legislative council, but resigned his seat on the ground that judicial and legislative functions did not harmonize. Retiring on a pension

in February 1861, he lived quietly in England, and died while on a visit to Rome on 22 March 1882. (Kt. Bach., 1860.)

Dickson, Sir James Robert (1832-1901), born at Plymouth on 30 November 1832 and educated at the Glasgow high school, became clerk in a Glasgow bank and in 1854 migrated to Victoria and joined the Bank of Australasia. After five years in this institution and three spent with relatives in business he in 1862 moved to Brisbane to become an auctioneer, was in this business until 1899, and incidentally found opportunity to promote the Royal Bank of Queensland. In 1872 he entered politics as member for Enoggera, and pinned his faith to S. W. Griffith: consequently he was brought into the Macalister ministry of 1874-6 as minister for mines during its last days, and became colonial treasurer in the Thorn-Douglas ministries (1876-9) that succeeded it. In the first Griffith ministry (1883-8) he was again treasurer from the end of December 1883 to the middle of August 1887; but then quarrelled with his colleagues over a projected land tax, resigned, was defeated at the elections of 1888, and from 1889 to 1892 travelled in Europe. On his return to Queensland he was elected to the assembly by Bulimba, and retained the seat till the end of the century. By this time the Griffith-McIlwraith coalition had been effected, and the treasurership was in the McIlwraith section, passing from that leader himself to Nelson in 1893 and to Philp in 1898; Dickson, however, was in 1897 brought into the Nelson ministry of 1893-8, and the next year became home secretary in the Byrnes ministry, succeeding to the premiership when Byrnes died in October. A capable if verbose minister, he was not a leader; his ministry passed through many vicissitudes and collapsed in December 1899, to be followed by a seven-days' Labour ministry (the first in Australia) and by the Philp ministry of 1899-1903, in which Dickson became chief secretary. He had been for some years a strong advocate of federation, and represented his colony at the federal council meetings of 1886 and 1896; he was also a delegate from Queensland in 1900 to discuss the Commonwealth bill with the imperial government. When Edmund Barton formed the first federal ministry, Dickson was therefore the obvious Queensland candidate for inclusion, and was offered the department of defence. Sworn in on 1 January 1901, he was suddenly taken ill during the Commonwealth celebrations, and died in Sydney on the 10th. (C.M.G., 1897; K.C.M.G., 1901.)

Dilleniaceae, a family of plants consisting of 4 genera and 122 species of trees, shrubs, herbs, or climbers. The flowers are yellow or white; sepals 5, persistent; petals 5, deciduous. The family is divided into 2 groups according to the veining of the leaves; the larger group (which is entirely tropical) has feather-veined leaves; the veins of the smaller group are netted. The former group is represented in Australia by one species only, *Wormia alata,* endemic in Queensland. The most important genus is *Hibbertia* with 116 species; 114 are endemic in Australia, the remaining two being natives of Madagascar. They are mostly shrubs or undershrubs, occasionally climbers, usually much branched and with small leaves. The sections are differentiated chiefly by the arrangement of the stamens, which may be free, united in clusters on one side of the ovary only, or surrounding it, and either interspersed with infertile examples (staminodia) or with all the stamens perfect. *H. volubilis,* a herbaceous climber frequenting the coastal sand-dunes, is a useful sand-binder. The genus *Adrastaea* has one species only, *A. salicifolia,* a somewhat rare plant found sparsely on the margins of peat bogs in New South Wales and Queensland. The genus *Pachynema* has 4 endemic species. They are perennial herbs or undershrubs with small flowers, having flattened or rush-like stems and small scales representing leaves.

Dillon, Peter (1785?-1847), born in Ireland—it is not certain when—was from 1809 onwards engaged in the sandalwood trade between China and the islands (including New Zealand) of the western Pacific. In 1813 he was third officer of the *Hunter,* a vessel trading between Sydney and China via Fiji, where she was to load with sandalwood and trepang; at Fiji he was given charge of the cutter *Elizabeth,* and after a collision with the natives rescued a Prussian settler, Martin Bushart, his Fijian wife and a girl companion, and took them to the island of Tucopia, between the New Hebrides and the Santa Cruz group. It is sometimes stated that this was the first European visit to that island, but Quiros had seen it in 1606 and Barwell in 1798; Dillon mentions it as 'the island of Topie' as though it were already well enough known. His conduct in taking native women away from Fiji was sharply questioned by Macquarie, but his explanation seems to have been accepted.

From 1814 to 1823 Dillon is only heard of occasionally, but on each occasion in connection with South Seas trading. In 1824, when master of the brig *Calder,* he rediscovered an island south of the Fiji group which Cook had seen in 1774 and named Turtle Island, but which had never been put on the chart; Dillon called it Barretto Island, after a patron of his in India, and it is now known as Vatoa. In 1826 he was taking his own vessel, the *St. Patrick,* from Valparaiso to Pondicherry when it occurred to him to look in again at Tucopia. Bushart was still there, and from him Dillon obtained a silver sword-guard that had been picked up on Vanikoro: he identified it provisionally as a relic of the lost La Pérouse (q.v.) expedition, made an unsuccessful attempt to land on Vanikoro himself, and then made for Calcutta, where he gave his news to the governor-general. An expedition to search the Santa Cruz group, and if possible rescue any survivors of the French party, was at once fitted out, and on 23 January 1827 Dillon sailed from the Hooghly in the E.I.C. ship *Research.* On the way he quarrelled with his medical officer Dr. Tytler, who sued him for assault and had him imprisoned at Hobart; Arthur, however, as lieutenant-governor cancelled the imprisonment—he said Dillon justly deserved the punishment, but the relief of possible survivors must not be delayed by his wrongdoing—and on 20 May the *Research* sailed again for Tucopia, which she reached via New Zealand, Tonga, and Rotumah on 5 September. On the 8th she was at Vanikoro, and Dillon discovered that one of La Pérouse's two vessels had been wrecked on the south-western reef and the other sunk just outside it; most of the crews had re-embarked in an open boat built by themselves, and were never seen again. This information was early in 1828 confirmed by the enquiries of Dumont D'Urville in the *Astrolabe,* who saw (and had sketches made of) anchors and other objects lying on the reef where the wreck had taken place.

Dillon returned to Calcutta with his relics in

April 1828, took them to France, and presented them to Charles X, then king; his reward was the title of chevalier of the legion of honour and a pension of 4000 francs a year. In 1829 he published a *Narrative* of his voyages, mainly taken up with personal matters. His subsequent history is obscure; in 1831 he was in Paris, hoping to visit Sydney soon; in 1835 Roger Therry met him in Sydney—'a large man, weighing eighteen stone'—and found him amusing. In 1836-8 he owned the schooner *Jess* and traded in her among the Pacific islands. In 1838 he returned to Europe, settled in Ireland, and died there on 9 February 1847.

Students of history may learn to appreciate the value of second-hand evidence by looking at Therry's account of Dillon and his discoveries (*Reminiscences*, pp. 128-9). In 1½ pages of narrative there is hardly one correct statement; La Pérouse becomes a ship, Vanikoro is confused with Pitcairn Island, and every date given is wrong; yet the writer, who was a man of high character and a judge of the supreme court, had met Dillon and heard the whole story from him.

Dillwynia, a genus of the family Leguminosae, consisting of shrubs with narrow cylindrical leaves channelled above, endemic in Australia. The flowers are in numerous small clusters, yellow to orange-red. *D. ericifolia* is a heath-like bush, exceptionally variable in habit, of which the numerous varieties maintain a long succession of bloom. In *D. floribunda* the flower-clusters are crowded into a spike at the tips of the flowering stem. *D. brunioides* is a low, spreading shrub, confined to a limited area on the Blue Mountains.

Dingo or **Warrigal** (*Canis dingo*), the only indigenous land mammal of the Carnivora found in the Australian fauna. It has all the structural characters of the genus *Canis*, and is about the size of an average collie—standing about two feet high and measuring about five feet from the end of snout to tip of tail; the muzzle is pointed, the ears rather short, erect, and broad at the roots, and the tail bushy and of moderate length. The jaws are remarkable for their terrific power, which enables the animal to tear away completely the flesh gripped in its bite, and so to kill its prey by mere shock. The colour of the back varies between the limits of light reddish-brown and black; the lower surface is always lighter; the feet and tip of the tail are often white. In many parts of Australia, but especially in the districts bordering on the Gulf of Carpentaria, the aborigines catch dingo pups and train them to hunt in packs; Carstensz, the first white man to describe Australian aborigines from personal observation, records that on several occasions he found tracks of men accompanied by numerous dogs. Aboriginal women often suckle the pups, which acquire a great affection for and loyalty to their foster-mothers. In the wild state the dingo usually hunts alone or with his lifelong mate, though big game are occasionally hunted by packs. He is monogamous, and probably the most intelligent of all wild dogs, though he rarely displays the docility of domestic varieties. In unoccupied country dingoes prey on marsupials—chiefly the smaller kinds, or the young of the larger—and on such birds as they can surprise on the ground. In partly settled districts they frequently destroy sheep, calves, and poultry, and an incessant warfare is waged against them by shooting and the use of dogs, traps, and poisoned baits. West of the Darling River their depredations have sometimes been so great as to make landowners substitute cattle for sheep on their runs. In 1891 there were 15,000,000 sheep on the Western Division of New South Wales, in 1911 7,000,000, and in 1923 4,765,000; and at least half this loss is attributed by the local Pastoralists' Association to the ravages of the dingo. On the other hand, within the last five years the number of dingoes seems to be decreasing, since in 1924 only 568 were killed in the West Darling areas, against 4290 killed in 1919. South Australia has a dog-proof fence along this part of her border, and deals with the pest internally by a vermin group-fencing act.

Though extinct in the thoroughly settled areas, dingoes occur all over the Australian mainland wherever conditions are favourable. From Tasmania they are entirely absent.

Bones of the dingo have been found along with those of various extinct marsupials (such as *Diprotodon* and *Nototherium*), and, as far as present evidence goes, its arrival in Australia considerably antedated that of aboriginal man himself.

See Etheridge in the *Memoirs* of the Geological Survey of New South Wales (Ethnology No. 25, 1916); and Wood Jones in the *Transactions* of the Royal Society of South Australia, vol. xlv (1921).

W.A.H.

Diplopoda. See MILLIPEDES.

Diprotodonts. See MARSUPIALS.

Diptera, a large order of insects whose name—two-winged—describes their essential characteristic. They are very numerous in Australia; but only a few of them—about 2000—have been described. The order is characterized by the reduction of the hind-wings to a pair of minute club-like organs, called balancers or halteres. The venation of the fore-wing is open, with scarcely any cross-veins. In the more archaic types the venation is not unlike that of caddisflies; but the first cubital vein (Cu_1) is always simple, and the full number of branches of the radial sector (Rs) is found only in a very few archaic forms. The mouth-parts are highly specialized, being adapted for piercing or sucking; the mandibles are either elongated spears, or absent; the maxillae are elongated, and in the higher types have reduced palpi; the labium has a bilobed terminal labellum, carrying more or less numerous pseudo-tracheae. The larva is very variable in form, but never possesses thoracic legs, and rarely abdominal pro-legs. In the higher forms, the larva becomes a maggot, with no visible head. The pupa is a *pupa obtecta;* but in the higher groups (Cyclorrhapha) it is developed within the dried larval skin, which forms a hard, oval puparium, and is then called a *pupa coarctata.*

The classification of this order is difficult. The usual division—which is followed here—is into two sub-orders, Orthorrhapha and Cyclorrhapha; the first sub-order has two divisions, the second three. The larva in Orthorrhapha has definite jaws set in a small head; the pupa is usually free (if it is enclosed in the larval skin, this does not assume the form of a true puparium); the head of the imago has no frontal lunule or ptilinum. In Cyclorrhapha the larva has neither definite jaws nor visible head; the pupa is enclosed in a hard, oval puparium, from which the imago escapes by making a hole at the anterior end; the imago has three-jointed an-

tennae with an arista, and in its wings neither R_{2+3} nor R_{4+5} is ever forked.

Nine species are figured on plate xi.

ORTHORRHAPHA, division Nematocera. In this division the antennae are composed of 6-40 joints, all closely similar. In the wings R_{4+5} is always a single vein (a few archaic genera excepted), and R_{2+3} either forked or single. Most species are slender and delicate. About 700 Australian species have been described, of which the dominant family Tipulidae accounts for more than a third. Flies of this family, known as crane-flies or 'Daddy-long-legs,' swarm in moist situations, their larvae living in mud, wet soil, and rotten logs. Among the large and handsomely-marked forms found in Australia species of *Plusiomyia* and *Macromastix* are notable, the latter abounding in springtime. Of the smaller species, the pretty *Gynoplistia bella* (fig. 34), is common about small streams in all parts of Australia.

The Blepharoceridae (net-veined midges) are a remarkable family of waterfall-dwelling insects, only recently discovered in Australia, though long known from New Zealand. The larvae cling to rocks, under swiftly rushing water, by means of six pairs of ventral suckers, and the pupae are also attached to rocks in similar situations. The adults sit or fly in the dense spray of the waterfalls, and are exceedingly slender and delicate insects, with long hind-legs. *Edwardsina australiensis* occurs on Mount Kosciusko, while species of *Neocurupira* and *Apistomyia* are also found on high mountain streams.

The Mycetophilidae (fungus gnats) are represented by nearly 100 species in Australia. The larva of an undetermined species is the glow-worm of mountain streams and caves; in some localities (e.g. at Bundanoon in New South Wales) the myriads of lights produced by these larvae as they hang in their webs upon the faces of moist rocks, form one of the sights of the district.

Of the Culicidae (mosquitoes, q.v.), Australia has a hundred described species, among which representatives of the maleficent genera *Anopheles* and *Aëdes* (*Stegomyia*) are included. One of the most feared of these insects, on account of its severe bite, is the Hexham Grey (*Mucidus alternans*), so named because it breeds in myriads on swampy flats at Hexham near Newcastle, N.S.W. The ordinary mosquitoes that are so annoying at night belong to several species of *Culex*, one of which (*C. fatigans*) has been introduced from ships.

Of the family Chironomidae (midges) nearly 80 species are known; about a quarter belong to the genus *Ceratopogon*, commonly called sand-flies. Although so minute, they have a very vicious bite. See BLOOD-SUCKING FLIES.

The Cecidomyidae (gall-gnats) are numerous in Australia, about 120 species having been described; most belong to the genus *Diplosis*. The spherical red galls formed on the mid-rib of eucalyptus leaves are caused by the larva of *Hormomyia omalanthi*.

Of other families, less than 20 Bibionidae are known, and a small number of Simuliidae (buffalo-gnats and Psychodidae (moth-midges). The two last-mentioned families are further discussed under BLOOD-SUCKING FLIES.

ORTHORRHAPHA, division Brachycera. In this division the antennae are nearly always composed of less than six joints, and mostly of three only (scape, pedicel, and flagellum). In the wings R_{2+3} is always a single vein, R_{4+5} forked in all but reduced forms. They are mostly stout, strongly-built flies. The number of Australian species is about 650, the dominant families being the Tabanidae (175 species), Asilidae (160) and Bombyliidae (130). The Tabanidae (March-flies) are met with everywhere; many species inflict severe bites on horses, cattle and human beings. (See BLOOD-SUCKING FLIES.) The family also contains some striking and beautiful harmless forms, especially on the highlands; note the handsome *Osca guttata* (fig. 35) and the rare *Pelecorrhynchus nigripennis* (fig. 36).

The Asilidae (robber-flies) are also met with everywhere, even in the driest parts. Australia possesses many large species, some as large as any known Diptera—e.g. the magnificent *Blepharotes coriarius* (fig. 37). Some species, e.g. *Chrysopogon crabroniformis* (fig. 38), mimic wasps. Robber-flies are useful in decreasing, by their incessant attacks, numbers of harmful insects; but some species have recently taken to attacking bees, and promise to become a serious pest to apiarists.

The Bombyliidae (bee-flies) are familiar objects in the bush, where species of the handsome genus *Comptosia*, such as *C. sylvana* (fig. 39), may be seen hovering or settling on the ground. Not unlike these are the Nemestrinidae, of which *Trichophtha'ma punctata* (fig. 40) is a well-known example.

The archaic Therevidae have their headquarters in Australia, being represented by about 60 species, none of very striking appearance. They are like small robber-flies, but without the hard, sharp beak of the latter.

The Leptidae, and the allied Stratiomyiidae (soldier-flies), are fairly well distributed in Australia, about 30 species of each being known. Of the former the biting leptids (*Spaniopsis*) are an annoyance in the bush in the autumn. Amongst soldier-flies the metallic black *Neoexaireta spiniger* is common in gardens and on window-panes, while the handsome flies of the genus *Odontomyia* may be seen on sunny days, at high altitudes, hovering motionless in the air over damp places.

Of the other families, about a dozen species of Cyrtidae (bladder-flies) are known, a few only of Apioceridae and of the large and handsome Mydaidae, and some 30 or more Empididae. Of the long-legged, metallic-green Dolichopodidae about a dozen are named; some are found resting upon citrus trees.

CYCLORRHAPHA, division Syrphoidea. This division, also called Aschiza by Brauer, includes only three families, Platypezidae, Pipunculidae, and Syrphidae. The head of the imago has neither a well-marked frontal lunule nor a ptilinum. The number of known Australian species is little over 100, of which two-thirds belong to the Syrphidae and nearly one-third to the Pipunculidae. The Syrphidae (hover-flies) are a family of handsome and beneficial insects, abundant in all parts of the world. They may be recognized by possessing a unique vein, the 'spurious vein,' developed longitudinally between Rs and M. Australia has several fine species of the widely-spread genus *Eristalis*; fig. 41 shows *E. Pulchellus*. The introduced Drone-fly (*E. tenax*) is very common in gardens. The larvae of *Syrphus* and its allies feed on aphides, and are of considerable value in checking these pests.

The large-headed parasitic flies of the Pipunculidae are not uncommon. Their larvae are para-

sitic upon various Homoptera. Perkins described 26 species of *Pipunculus* from Queensland.

CYCLORRHAPHA, division Muscoidea or Myiodaria. This division (called Schizophora by Brauer) contains a large number of families, all recognizable by the presence of the frontal lunule and ptilinum, and by a simplified venational scheme in which neither the branches of Rs nor those of M are forked. It is usually divided into the Acalyptrata—in which the squame is small, and does not fully cover the halter—and the Calyptrata, in which the squame is large, quite hiding the halter from sight.

The Acalyptrata consist of 20 or more families, very difficult to classify. Little work has been done upon the Australian species. Several handsome species of the Conopidae (wasp-flies) are to be found, but none appear to be common. The Phycodromidae (kelp-flies) are found infesting seaweed on the beaches; the Sepsidae are small black flies that breed in decaying vegetables, skins, cheese, etc.; the Ortalidae are handsome flies with metallic bodies and coloured wings, of which *Lamprogaster lacta* is one of our commonest and most beautiful species; the Trypetidae (fruit-flies), include one of our worst pests, *Chaetodacus tryoni*, the Queensland Fruit-fly (see FLIES); some striking species with stalked eyes, belonging to the genera *Achias* and *Zygotricha*, are found in Queensland.

The Calyptrata include only six families—five of which, however, are very large. The Anthomyiidae are distinguished by having the first posterior cell wide open; they include a number of species resembling the house-fly in many respects. The Sarcophagidae (scavenger-flies) are usually marked with pale longitudinal stripes; one of our commonest species is the handsome *Sarcophagus aurifrons*. To the Oestridae belong the Sheep-fly (*Oestrus ovis*), and the Bot-fly (*Gastrophilus equi*), an introduced pest. The very large family Muscidae includes the house-fly and the numerous species of blow-flies, the latter belonging to the genera *Calliphora* and *Lucilia*. These are amongst the worst of all insect pests, several species making life almost unbearable inland in the summer, while others attack sheep by blowing the wool.

The large families Tachinidae and Dexiidae are closely allied, and by some authors not separated. They contain many large and handsome species, whose larvae are for the most part parasites on caterpillars, and are therefore distinctly beneficial. One of our prettiest species, a Dexiid, is *Amenia leonina* (fig. 42). The genus *Rutilia* includes a number of very fine species, which may be seen in summer hovering high in the air, or resting upon the trunks of forest trees; of these *R. formosa* is one of the largest and commonest. The Long-legged Fly (*Myocera longipes*) is another common species, of very graceful build, often seen resting upon tree-trunks, especially in evening sunshine.

Much work remains to be done upon the Australian Muscoidea, less than 500 species having so far been described, out of probably more than 1000 existing.

CYCLORRHAPHA, division Pupipara. This division consists of parasitic and often wingless flies, living upon warm-blooded vertebrates; the larva is born just before pupation. These extraordinary insects are clearly a recent, highly-specialized offshoot of the Muscoidea. Only two families are recorded from Australia. In the Hippoboscidae (louse-flies) we have a number of species of the genus *Ortholfersia*, of which the Wallaby-fly (*O. macleayi*) is probably the best-known. The Sheep-tick (*Melophagus ovinus*) is an introduced pest.

The Nycteribiidae are wingless, spider-like insects, parasitic upon bats. A large species, *Cyclopodia pteropus*, is not uncommon on flying-foxes, while a number of smaller species have been found upon our insectivorous bats. For the economic importance of Diptera, see FLIES.

R.J.T.

Dixon, JAMES (1758-1840), born at Wexford in Ireland in 1758, educated at Salamanca and Louvain, and ordained priest in 1784, was in 1798 sentenced to death for participation in the Irish rebellion of that year. The sentence having been commuted to transportation for life, he was sent to Sydney, arriving on 16 January 1800. His excellent conduct led Governor King to regard him as worthy of emancipation, and the British government authorized this on condition he did not leave the colony; before, however, their permission was received, King on 19 April 1803 granted him a conditional emancipation in order to let him exercise his clerical functions, celebrating Sunday Mass at Sydney, Parramatta, and the Hawkesbury in rotation. This was the first recognition of the Roman Catholic Church in Australia. When the news reached Europe the Pope made Father Dixon prefect apostolic of New Holland; and King allotted to him an official salary of £60 per annum. On 1 March 1804 King reported that this measure 'had the most salutary effects' and that there was not 'the most distant cause for complaint;' and Johnston, when he rode out to suppress the Irish outbreak at Castle Hill on the 4th, took Father Dixon with him; but in the following August King withdrew the salary and cancelled the permission to officiate as priest, seemingly because he believed that the Sunday services had been turned into seditious meetings. It is probable, however, that he continued his ministrations surreptitiously until in 1808 leave was given him to return to Ireland; there he was stationed at Crossabeg in county Wexford, taking charge of the district in 1819 and dying there on 4 January 1840.

E.M.O'B.

Dobson, SIR WILLIAM LAMBERT (1833-1898), the eldest of three brothers who played a great part in the responsible government period of Tasmanian history, was the eldest son of John Dobson, a solicitor who migrated to Tasmania in 1834. W. L. Dobson was born at Gateshead in Durham on 24 April 1833, educated at the Hutchins school in Hobart, trained for the law in London, called to the bar at the Middle Temple on 6 June 1856, and admitted to the Tasmanian bar in January 1857. In 1859 he was appointed crown solicitor, and two years later entered the assembly and became attorney-general in the Weston ministry (5 February 1861), retaining the post under T. D. Chapman until 20 January 1863 and resuming it under Dry and Wilson from 24 November 1866 to 5 February 1870, when he took his seat on the supreme court bench. On 7 February 1885 he succeeded Sir F. Smith as chief justice, and held that position till his death on 17 March 1898. From 1890 he was chancellor of the university of Tasmania. (Kt. Bach., 1886; K.C.M.G., 1897.)

His younger brother HENRY (1841-1918), born at Hobart on 24 December 1841 and educated

at the Hutchins school, was called to the Tasmanian bar in 1864 and practised his profession until 1891, when he entered the assembly as member for Brighton; on 17 August 1892 he displaced the Braddon-Fysh ministry, and became premier with Adye Douglas and N. E. Lewis (q.v.) as colleagues. Ousted by Braddon on 14 April 1894, he began to interest himself in the federation movement, represented his colony on the federal council, and was elected one of its representatives to the convention of 1897-8, in which he was a member of the judiciary committee. In the campaign which followed he was a leading supporter of the bill, and in March 1901 was elected a senator. This position he held until 1910, when he was defeated. He died at Hobart on 10 October 1918. Outside politics he was a zealous and hard-working citizen, especially interested in the development of the Tasmanian tourist traffic, which, thanks to his energy, attained a great volume.

Another brother ALFRED (1848-1908), born at Hobart on 18 August 1848 and educated at the Hutchins school, was trained for the law in England, called to the bar at the Inner Temple on 25 January 1875, and admitted to the Tasmanian bar on 10 September in the same year. He entered politics almost immediately, being elected for Glenorchy to the assembly in June 1877, and on 13 August became attorney-general under Philip Fysh. In 1882-4 he was leader of the opposition; in July 1885 he was elected speaker of the house, but on 29 May 1887 resigned to take the non-political post of solicitor-general. In April 1901 he was made agent-general for the State in London. He was accidentally drowned in the English Channel on 5 December 1908. (C.M.G., 1904.)

Dock. See NOXIOUS PLANTS.

Docks. See HARBOURS and MORT'S DOCK.

Dodder. See CONVOLVULACEAE.

Dodds, SIR JOHN STOKELL (1848-1914), was born at Durham in England in 1848 and brought to Tasmania as a boy. His father died when he was 16, and thenceforward he supported his mother in addition to educating himself. According to tradition, he became an office boy when so small that his head could hardly be seen over the counter. He read for the law, and was called to the Tasmanian bar in 1872; he also found time for a very successful career in rowing, a sport in which he retained a life-long interest. Entering politics in 1878 as member for East Hobart, he took office in December as attorney-general in the Crowther ministry, and retained that office for two years in the Giblin ministry that followed it; on 1 December 1881 he exchanged offices with Giblin, and became treasurer; when Giblin went to the supreme court in 1884, he reverted to his old position under Adye Douglas, and retained it under J. W. Agnew until 15 February 1887, when on Giblin's death he took the vacant judgeship. He was thus in office continuously for more than eight years under four premiers. He represented Tasmania on the federal council in 1886, and at the colonial conference of 1887.

In 1894 he acted as chief justice during the absence of Sir W. L. Dobson, and succeeded to that post on Dobson's death in 1898, becoming also lieutenant-governor in 1903. Apart from politics and the law, he interested himself in literature, education, and sport, and was from 1907 to 1914 chancellor of the university of Tasmania. He died on 23 June 1914. (C.M.G., 1889; K.C.M.G., 1901.)

Dodonaea, a genus of the family Sapindaceae, consisting of shrubs (often tall) and, rarely, trees; 50 species are endemic in Australia. The flowers are unisexual, the sexes often on distinct plants; fruit usually a membranous capsule; leaves simple or divided into leaflets. These plants are generally known as 'hop-bushes,' since the inflated fruits, both in taste and in appearance, resemble the common hop. Many species are ornamental shrubs, worthy of cultivation, and are easily propagated from seeds. The leaves of several species growing in arid districts are eaten by stock in times of drought. *D. viscosa* extends to India, where its timber is used for turnery, inlaying, etc. The wood is dense and of a flinty nature, and will often turn or notch the edges of a well-tempered axe.

Dog-fishes, small sharks of the family Squalidae which have a stout spine before each dorsal fin; they are often called 'piked dog-fish' to distinguish them from the species of another family (Scylliorhinidae) which are known to English fishermen as 'hounds.' Piked dog-fish or skittle-dogs are abundant in all cool seas, and as many as 20,000 have occasionally been taken in a single haul of a net. In some countries they are largely sought by fishermen for the oil contained in their livers, while their flesh is of such good quality that a considerable quantity is imported into Australia and sold under various fictitious names, e.g. 'smoked haddock.' Several species are plentiful in Australian waters, and are taken by trawlers. They attain a length of nearly three feet; but a species occurring in the Philippine Islands bears the distinction of being the smallest shark known, adults being only six inches long.

Allied to the dog-fishes are a number of little-known genera and species that occur in deeper waters. The extraordinary Prickle Shark (*Oxynotus*) is entirely covered with short spines; its curious angular body is compressed, and sharply demarcated from the perfectly flat belly. Others, of the genera *Spinax* and *Etmopterus*, which are restricted to deep waters where no daylight penetrates, are black in colour and have luminous organs on the lower surface.

A. R. McC.

Dogwood, vernacular name of *Myoporum platycarpum* (see MYOPORUM); but the Tasmanian dogwood is a *Bedfordia*.

Dolichos, a genus of the family Leguminosae, consisting of twining or trailing herbs, rarely erect; largely South African, with a few tropical and South American species. The only species indigenous to Australia is *D. biflorus*, the 'horse gram' or 'kulthi' of India. The beans are usually fed to horses, but the whole plant is useful as fodder. The poorer class of natives in the Punjab use the beans as an article of diet. Several exotic species are grown as ornamental vines.

Dollar-bird, the only representative in Australia of the family of birds known as rollers (Coraciidae), bright-plumaged birds found throughout the warmer parts of the eastern hemisphere. The Dollar-bird (*Eurystomus orientalis*) has greenish-blue plumage with a large round white patch in the centre of each wing, very conspicuous when it is flying. These patches

are said to be the origin of its name, as they look like silver coins. The beak is very wide, and bright red in colour.

Dollar-bird.

The dollar-bird occurs throughout northern and eastern Australia during the summer, retreating northwards to the Malay Archipelago for the winter. It is very noisy, with a peculiar, chattering note; its flight is remarkable, as it rarely flies straight for any distance, but tumbles and twists in the air. This peculiarity, which it shares with the rest of the family, accounts for the name 'rollers.' The white eggs are laid in a hole in a tree, generally near the extremity of a dead branch, and the bird is clever enough to mislead searchers for its nest by flying into other holes. W.B.A.

Dolphins, vernacular name of the family Delphinidae and especially of the genus *Delphinus*, the typical species of which—*D. delphis*, the Common Dolphin—ranges over all seas except the Arctic and Antarctic areas. In Australia, however, where the Porpoise (*Phocaena communis*) of European seas is not known, *D. delphis* is usually but wrongly called 'porpoise;' porpoises, however, have a rounded muzzle, while dolphins have a sharply-defined, narrow beak. Skeletons of the common dolphin are to be seen in the Australian (Sydney), National (Melbourne), and Queensland (Brisbane) museums. Besides the common dolphin two or three other species of dolphin occur in Australian seas.

The Southern Bottle-nosed Dolphin or Cowfish (*Tursiops catalania* or *truncatus*), which inhabits Australasian seas, is distinguished from the true dolphins (*Delphinus*) by its shorter and more tapering beak, and the smaller number and larger size of the teeth. A skeleton and a coloured cast of this dolphin are in the Australian Museum, and a skull in the Queensland Museum.

Long-beaked dolphins of the genus *Sotalia*—which are estuarine, and ascend rivers in other parts of the world (e.g. Brazil and China)—are known to occur on the Australian coast; but nothing seems to be known of their mode of life. A skeleton of *S. gadamu* and a skull and mounted specimen of *S. lentiginosa* are in the Queensland Museum. W.A.H.

Domatia are peculiar structures found on the leaves of certain plants, of which *Pennantia Cunninghamii* (see OLACINACEAE) is a good example. On the under-side of the leaf they form small round openings, with a thickening round the orifices, occurring at the axils of the primary and secondary veins and again in the secondary and tertiary axils. These open into an almost spherical cavity, which on the upper surface of the leaf, shows as a little hump. Lundstrom's theory of their structure is that they are 'hereditary galls' caused in the remote past by minute acari, but now produced without these mites—a good instance, if true, of the transmission of acquired characters. Continued observation of these structures does not, however, favour this theory; but no other satisfactory explanation has been given. It is remarkable that the majority of domatia-bearing plants grow in the southern hemisphere, whereas in Australia none occur on plants in sandstone country.

Donaldson, SIR STUART ALEXANDER (1812-1867), son of a London merchant with Australian trade connections, was born in London on 10 December 1812, educated privately, and in 1832 sent by his father to the silver-mines of Guanajuato in Mexico for business training. Returning to England in 1834, he migrated to Sydney to enter the employ of Dawes, Gore & Co., rising later to be head of the firm and transforming it into Donaldson & Co. In 1848 he entered the legislative council as member for Durham, retaining the seat until February 1853; he was a marked man from the start, and in 1849 was an unsuccessful candidate for the speakership. Associating himself with Wentworth, Martin and Lowe, he took a prominent part in the long campaign for responsible government; he was also an active supporter of Caroline Chisholm's (q.v.) colonization scheme, and an ardent advocate of steam communication with Britain. In 1853 he left the council to visit England, but rejoined it two years later as member for Sydney Hamlets, and was for a time vice-president. When responsible government was given the colony in 1856, Donaldson and Charles Cowper (q.v.) were the two most prominent men in local politics; neither would serve under the other, and Denison asked Donaldson to form the first ministry. Parties being still inchoate and party discipline non-existent, the ministry lasted less than three months, and was succeeded by a Cowper ministry that lasted barely five weeks; then Donaldson took office again as treasurer in a ministry headed by Henry Watson Parker (q.v.) which stayed in for 11 months; on leaving office in 1857 he was made commissioner for railways. During these years he was member of the new assembly for Sydney Hamlets (March-October 1856) and the south riding of Cumberland (November 1856 to April 1859). By this time he had wearied of colonial life, and at the elections of 1859 abandoned politics and returned to England. There he re-entered business (from which he had retired when made premier), made several unsuccessful attempts to gain a footing in British politics, and died at Carleton Hall in Cumberland on 11 January 1867.

His public services were remarkably varied. He was from the first a believer in establishing local industries, and in the late forties had a

cloth factory at Stockton near Newcastle, N.S.W. He helped to found the university of Sydney—although he opposed Wentworth's bill of 1849 on points of detail—and was a member of its senate from 1850 to 1861. As first premier he had to formulate a scheme of departmental administration, and devised one with four main departments—each represented in parliament by a minister—a chief (or 'colonial') secretary's, an attorney-general's, a treasurer's, and one of lands and works; he also abolished the custom by which the auditor-general had been a political officer. His tenure of office under H. W. Parker was responsible for several valuable acts, but particularly for his insistence on sound finance: confronted with the British government's determination to make a separate colony in the north, he led the assembly in protesting both against the suggested revival of transportation to Moreton Bay and the districts north of it and against including New England and the Clarence River valley in the new colony. Among the minor events of his life his duel with Sir T. L. Mitchell (who had, he considered, offended his honour by a speech) is best remembered; but it was taken seriously by no one except (possibly) the duellists themselves, and they were neither injured nor reconciled. This was the last duel fought in Australia. (Kt. Bach., 1860.)—His younger brother, JOHN WILLIAM DONALDSON (1811-1861) was the author of the *New Cratylus, Varronianus* and other famous works of classical scholarship.

Stuart's son, ST. CLAIR GEORGE ALFRED DONALDSON, born in London on 11 February 1863 and educated at Eton and Trinity College, Cambridge, was ordained in 1888, made head of the Eton mission at Hackney Wick in 1891, was rector of Hornsey in 1901-4, and was installed Anglican bishop of Brisbane on 21 December 1904. His see was raised to an archbishopric in the following year, when the dioceses of Brisbane, Rockhampton, North Queensland, Carpentaria, and New Guinea were formed into a province with him as metropolitan. His energy so hurried forward the building of St. John's cathedral at Brisbane—the foundation-stone of which had been laid in his predecessor's time—that an important part of it was in use before he left the diocese. His chief work, however, was educational: he founded St. Francis College at Nundah for training young ministers, St. John's College within the university of Queensland, and seven important secondary schools attached to the Church of England in southern Queensland, and was active in procuring the admission of the clergy of all denominations to give religious teaching in state schools. In 1921 he resigned the archbishopric, and returned to England to become bishop of Salisbury.

Donohoe, ANDREW (1842-1897), born in Sydney in 1842, obtained a certain amount of theatrical experience from amateur performances and work with travelling companies in Australia—his first public appearance was made in a hall attached to the Red Cow inn at Parramatta. He was unknown to fame until, after much provincial work in England, he appeared with Dion Boucicault in 1870 under the *nom de théâtre* of Shiel Barry. Several years of stock work followed: but in February 1878 he appeared as Gaspard in *Les Cloches de Corneville*, a performance which was largely responsible for the play's three-year run and frequent revivals, and which was described by a competent critic as belonging 'to the very highest order of eccentric comedy.' Securing the rights of the play, he toured England and the United States with it; occasionally he appeared in other parts, but they seem to have been of the same type, written up to his reputation as Gaspard. He died on 13 March 1897.

Dorcas Kangaroo, a genus (*Dorcopsis*) of the Macropodidae (see KANGAROOS) supposed to connect the tree kangaroos (q.v.) with the more normal members of the group. The three species are all confined to Papua; in them the disproportion between the fore- and hind-limbs is less strongly marked than in the ordinary kangaroos, though more strongly than in the tree kangaroos. The name *Dorcopsis* (from *dorcas*, an antelope) is meant to signalize this feature, and the general proportions of head and body. One of the species, the Brown Dorcopsis (*D. mulleri*), is an inhabitant of north-western Papua and some of the adjacent islands. Another, the Grey Dorcopsis (*D. luctuosa*), is found in the east and south-east, and the third, Macleay's Dorcopsis (*D. macleayi*), has been found on the south coast. On Mysol Island is found a small distinct insular species (*D. mysoliae*) allied to *D. mulleri*. See MARSUPIALS. W.A.H.

Dories, fishes of the family Zeidae. The well-known John Dory (*Zeus faber*) of European seas also occurs in Australian waters, and is not infrequently captured by trawlers. It is of rather hideous appearance, having a greatly compressed body with long trailing fins, huge saucer-like eyes, and a remarkably extensible and capacious mouth. On each side of the body is a circular spot, which tradition says was left by the thumb and finger of St. Peter upon

John Dory.

the ancestors of this species when he captured specimens to obtain tribute money. From the times of the Romans onward, the John Dory has been ranked as one of the finest of table-fishes, and, since it sometimes reaches a length of two feet, and is firm and fleshy, it commands a ready sale. Another rarer but equally palatable species is the Mirror Dory (*Zenopsis nebulosus*) of deep water, whose smooth, scaleless, and circular body is brilliantly silvered like a looking-glass. The Silver Dory (*Cyttus australis*) is another deep-water representative, as is the Big-eyed Dory (*Cyttosoma boöps*), found at depths of 300 fathoms in the Great Australian Bight; in this species the eyes reach their maximum development, and occupy more than half the entire bulk of the head. A.R.McC.

Dormouse Opossum, a genus (*Dromicia*) of pigmy Australian phalangers (see OPOSSUMS). In the Pigmy Dormouse Opossum (*D. nana*) the head and body together are about four inches long, the tail a little more than four inches. The fur is soft and thick, of a uniform dull fawn colour above, lighter below. The ears are relatively large and thin. The tail is slender and cylindrical, furry at the base, scaly in the rest of its extent. *D. nana* is common in Tasmania, and has quite recently, after careful search, been found to be numerous in some parts of New South Wales and Victoria. It forms nests of leaves in hollow limbs of eucalyptus trees.

Still smaller is the Lesser Dormouse Opossum (*D. lepida*), which is confined to Tasmania. The Long-tailed Dormouse Opossum (*D. caudata*), whose tail is nearly half as long again as its head and body together, inhabits north-western Papua, and the Western Dormouse Opossum (*D. concinna*) occurs in South and Western Australia. The closely allied genus *Endromicia* is represented by *E. macrura*, found on the Atherton-Herberton tableland in northern Queensland; it resembles *D. caudata*, but the body is longer and the tail shorter. Its coloration is light chocolate-brown above, grayish white below.

The vernacular name of the genus *Dromicia* refers to its habit of curling up like a dormouse when it hibernates. See MARSUPIALS.

W.A.H.

Doryanthes. See AMARYLLIDACEAE.

Dotterels. See WADERS.

Douglas, JOHN (1828-1904), born in London on 6 March 1828 and educated at Rugby school and the university of Durham, migrated to New South Wales in 1851 and was appointed a goldfields commissioner. Dropping this to take up squatting—in which he had little success—he entered New South Wales politics in 1859, represented Darling Downs for five months (until Queensland became a separate colony) and Camden for seven; then, making his home in Queensland, he left the New South Wales assembly and was elected to the Queensland house on 21 July 1863 for Port Curtis. Being an able and well-educated man and a good speaker, he soon became a recognized candidate for office. He served in the Macalister ministries of 1866-7 as postmaster-general, colonial treasurer and secretary for public works, and in the Lilley ministry of 1868-70 as postmaster-general, but resigned in November 1869 to become agent-general for the colony. In 1871 he returned to Queensland, in 1875 was elected for Maryborough, and was secretary for lands in the Thorn ministry of 1876-7. Out of the remnants of the Thorn ministry (see THORN, GEORGE) he formed a ministry of his own, with S. W. Griffith as his attorney-general and chief colleague, which lasted from 8 March 1877 to 21 January 1879. He was then defeated by Thomas McIlwraith, but continued to take an active interest in politics, and on 4 February 1881 publicly advocated the construction of railways by means of land grants—some enterprising company being formed to build the line, taking its pay in grants of land along the route, and handing over the completed line to the government to work. This policy was afterwards taken up by McIlwraith. In 1885 Douglas was made government resident at Thursday Island, and held the post till his death on 23 July 1904. From December 1885, when Sir Peter Scratchley died, to September 1888, when British New Guinea was proclaimed a British possession, he was also special commissioner for that protectorate.

Douglas, SIR JOHN ADYE (1815-1906), born near Norwich in England on 30 May 1815, and at first intended for the navy, was diverted to the law, became a solicitor in 1838, and next year migrated to Hobart and was admitted to the local bar. After an interlude of squatting in Victoria, he settled at Launceston in 1842 and there became a leading lawyer. In the early fifties he was active among the anti-transportationists (see TRANSPORTATION), and in 1855 entered the legislative council as member for Launceston. His activities as a citizen were manifold; he vigorously advocated the building of railways, was a member of the council of the university of Tasmania, and consistently urged the closer union of the Australian colonies. He represented his colony (*a*) in 1863 at a conference on intercolonial tariffs, (*b*) in 1887 at the colonial conference in London, (*c*) in 1891 at the federal convention in Sydney. His career in local politics was uneventful. In the assembly he represented successively Westbury, Norfolk Plains, and Fingal; became premier in 1884; resigned in 1886 to become the first agent-general of the colony; returned to Tasmania at the end of the following year, and re-entered the council as member for Launceston in 1890; was chief secretary in the Dobson ministry from 1892-4, and then became president of the council. In 1904 he retired from public life, and died at Hobart on 10 April 1906. (Kt. Bach., 1902.)

Dove. See PIGEONS.

Dowling, SIR JAMES (1787-1844), born in London on 25 November 1787 and educated at St. Paul's School, while studying for the bar earned his living as a reporter of parliamentary debates, was called to the bar at the Middle Temple on 5 May 1815, and for many years practised on the home circuit and at the Middlesex sessions, being also joint-editor of Dowling's and Ryland's *King's Bench Reports*, 1822-31, and of *Reports of Cases Relating to the Duty and Office of Magistrates*, 1823-31. Early in June 1827 he approached Lord Goderich with an offer of his services whenever a colonial judgeship should be vacant, obtained the backing of Henry (afterwards Lord) Brougham, declined the chief justiceship of Dominica and the chief justiceship of Sierra Leone on account of the climate, and on 6 August of that year was made a puisne judge of the New South Wales supreme court, entering on his duties on 3 March 1828. Eight years later he became acting chief justice during the absence of Sir F. Forbes, and on 30 August 1837 was confirmed in that office; he thus became an ex-officio member of the legislative council, but took no active part in the angry debates of the time. By 1844 he was worn out; 'during the whole period of his career' says Sir R. Therry, 'he was daily engaged in some one or other of the multifarious duties of the supreme court . . . In New South Wales a judge has no respite from work, no Long Vacation; the court may literally be said to be sitting the whole year round.' He obtained leave of absence, and was on the point of sailing for England when he died on 27 September 1844.

An excellent case-lawyer, a fluent speaker, and a kindly and considerate man, he enjoyed great and constant popularity in his lifetime, and

died a victim to scrupulous anxiety and excessive toil. Several of the Sydney streets record his memory. Receiving, as was usual in those days, a grant of land within the precincts of Sydney, he chose a block on the far side of what was afterwards known as Woolloomooloo; when streets were made through this land, he gave them the names Victoria (his Queen), Brougham (his patron), Forbes (his colleague) and Dowling. (Kt. Bach., 1838.)

His son, JAMES SHEEN DOWLING (1819-1902), born in London on 2 December 1819 and educated under Dr. Lang and W. T. Cape and at the Sydney College, was sent to England in 1836 to study law, graduated LL.B. at King's College, London, in 1841, and was called to the bar at the Middle Temple in 1843. Hearing of his father's death, he returned to Sydney in 1845, was admitted to the New South Wales bar on 20 October, and in 1846 made judge advocate for the new colony of North Australia (see GLADSTONE COLONY). This appointment, however, was extremely brief: he left Sydney with Colonel Barney on 8 January 1847, and was back again by 4 May, Earl Grey having suddenly countermanded the orders of W. E. Gladstone for the foundation of the colony. Resuming his practice in Sydney, he became successively police magistrate (1851), crown prosecutor for the colony (1857), and district court judge (1858). In August 1889 he retired on a pension, and died on 4 May 1902.

Downer, SIR JOHN WILLIAM (1844-1915), was born at Adelaide on 5 July 1844, educated at St. Peter's College, trained for the law, admitted to the local bar in 1867, and made a Q.C. in 1878. In that year he was elected to the legislative assembly from Barossa, which constituency he represented continuously until 1901. From 1881 to 1884 he was attorney-general in the Bray ministry and responsible for important legal reforms; from 1885 to 1887, and again in 1892-3, he was premier. Interesting himself in the movement towards federation, he represented his colony at the Sydney convention of 1883, the colonial conference in London in 1887, and the federal conventions of 1891 and 1897-8; he was also a South Australian member of the federal council of 1889. He was elected to the first senate of the Commonwealth (1901-3), but at the end of the term returned to State politics and in 1905 entered the State legislative council; of this body he was a member till his death at Adelaide on 2 August 1915. (K.C.M.G., 1887.)

Dracophyllum, a genus of the family Epacridaceae, consisting of four species (shrubs or small trees) distributed over Australia, New Zealand, and the Antarctic islands. The flowers (white, pink, or purplish) are in spikes; corolla-tube cylindrical to bell-shaped with 5 spreading lobes; stamens enclosed in the tube. The closely packed leaves, whose bases sheath the stems as in *Dracaena* (from which the generic name is derived), give a monocotyledonous aspect to the plant. *D. secundum* grows in the crevices of dripping rocks. Its pendulous branches, tipped with spikes of creamy white or pink flowers, are very attractive.

Dragonflies, insects belonging to the order Odonata, of which nearly 200 species are known in Australia. Though frequently miscalled 'horse-stingers,' they are quite harmless and even beneficial, as they destroy mosquitoes and other small insect pests.

The order is one of the oldest and most isolated of winged insects. The imagines are recognizable by their extraordinary facies, resembling miniature aeroplanes; some of the more important ordinal characters are the minute antennae, huge eyes, tiny neck pivoting the head, reduced prothorax, and immensely strong synthorax placed obliquely to the rest of the body —so that the legs are brought forward, close up to the mouth, while the wings are placed far backward above the base of the abdomen. The abdomen is long and slender, with the unique copulatory apparatus of the male on its second segment; the scheme of venation also is unique and complicated, with its triangle or quadrilateral, nodus and pterostigma. The larvae are aquatic, and are characterized by the possession of a unique prehensile mask formed from the lower lip. There are two well-marked sub-orders.

In the sub-order Anisoptera the hind-wings are somewhat shorter and broader than the fore-wings; an oblique vein and a true triangle are always present. When at rest the wings are held extended. The larva breathes by means of very highly-developed rectal gills.

The large family Aeschnidae, which contains some of the most archaic of all dragonflies, is well represented in Australia. Huge species of *Petalura* occur on mountain swamps in eastern Australia; *P. ingentissima*, which expands 6½ inches, is one of the largest dragonflies known. The very beautiful Petaliinae are represented by two genera, their nearest allies being found in Chile; these dragonflies—of which *Austropetalis patricia* (plate xix, fig. 17), from the Blue Mountains in New South Wales, is the best-known—are marked with brown or ruby spots along the wing-border; their larvae live on the faces of waterfalls, clinging to moss, debris, etc. The Gomphinae are well represented by numerous species of *Austrogomphus* and *Hemigomphus;* the beautiful, large, spotted Aeschninae, whose headquarters are the sub-alpine highlands, by many magnificent forms, of which the grand *Austrophlebia costalis* is probably one of the swiftest insects in the world, its speed being estimated at nearly 60 miles an hour. The dominant genus in this sub-family is *Austroaeschna,* with more than a dozen species.

The Libellulidae are especially well represented by their older sub-family Corduliinae, which has its headquarters here. The dominant genera are *Synthemis* and *Hemicordulia,* the former containing graceful, slow-flying insects with bodies beautifully marked with creamy or yellow spots, the latter swift-flying green and orange species with brilliant green eyes. The small orange-and-black species of the genus *Cordulephya* sit with their wings closed, like damsel-flies. Numerous genera of the sub-family Libellulinae are also to be found, especially in Queensland, where a large number of offshoots from the Oriental fauna have taken possession of the coast-line. The most striking of these are the brilliant red-bodied species of *Lathrecista, Orthetrum, Rhodothemis,* and *Diplacodes,* and the glorious butterfly-like *Rhyothemis,* which floats airily about displaying the gorgeous colours of its wings.

The sub-order Zygoptera comprises the smaller species known as damsel-flies, distinguished by their slender build, the equal size of the fore- and hind-wings (which are nearly always held folded over the body in repose), the absence of a true triangle (a simpler formation of a narrow quad-

rilateral cell being present), and the absence of the oblique vein. The larvae possess three elongated caudal gills; but respiration is shared between these and the rectum. The beautiful Calopterygidae, with their gorgeously coloured wings, are mostly a tropical group, the only Australian genus being *Diphlebia*, containing some lovely blue-bodied species found resting on rocks, twigs, etc., with outspread wings. The most striking of these is the black-winged *D. euphoeoïdes*, from northern Queensland (plate xix, fig. 18).

As regards the family Lestidae, Australia is the home of the archaic genus *Synlestes*, of which the best-known species is *S. weyersi*, with a very long and slender body, brilliant metallic-green in colour. The bronze and blue species of *Austrolestes* are abundant in most localities.

The dominant family Agrionidae contains many interesting forms. Chief among these is *Argiolestes*, a genus which rests with outspread wings and contains some beautiful species; though *A. icteromelas*, by far the commonest, is a very dull creature. The large *Podopteryx roseonotata* (rich black with pink spots on the thorax) is a rare insect found only in the scrubs of northern Queensland, where it is called 'wongera-wongera' by the aborigines. A number of species of the highly reduced Protoneurinae, the slenderest of all known insects, are found in eastern Australia, the best-known being the lovely orange-and-black *Nososcticta so'ida* (plate xix, fig. 19). In the sub-family Agrioninae are many small species, of which we can only mention the red-and-bronze *Xanthagrion erythroneurum*, common on all inland waters, and the equally common, but smaller and more brilliant, *Ischnura aurora*, one of the loveliest little creatures imaginable. Equally interesting is the metallic green *Hemiphlebia mirabilis* which indulges in a remarkable courtship before pairing, the male and female waving signals to one another from the reeds, and then flying out and indulging in a miniature *pas de deux*.

See Tillyard's *Biology of Dragonflies* (1917), and his papers in the *Proceedings* of the Linnean Society of New South Wales, 1905-18, and in the *Journal* of the Linnean Society of London, 1916.

R.J.T.

Drake, James George, born in London on 26 April 1850 and educated at King's College school, in 1874 migrated to Queensland and took up journalism, eventually joining the Hansard staff in Brisbane and studying law in his spare time. In 1882 he was admitted to the local bar; in 1888 he was sent to the assembly by the Enoggera electorate, and retained the seat until 1899, when he was nominated to the council. Entering federal politics in 1901, he was elected senator from Queensland, but retired altogether in 1906 and resumed the practice of his profession. On 7 December 1899 he joined the Philp ministry as postmaster-general and secretary for public instruction, and on 1 February 1901 left this position to become postmaster-general in the first (Barton) federal ministry. In the 'general post' which followed Kingston's resignation in August 1903 Drake became minister for defence for six weeks, in the succeeding (Deakin) ministry was attorney-general, and in the Reid-McLean ministry vice-president of the council. His name is not connected with any special legislation. On 13 January 1910 he was appointed crown prosecutor in the district courts of Queensland, and retired on 30 December 1920.

Drama. The first play connected with Australia was performed neither in Australia nor in London, but in Paris, where on 24 November 1792 'Les Emigrés aux Terres Australes' was produced at the Théatre des Amis de la Patrie. Suggested by the travels of La Pérouse (q.v.), who had been last heard of at Botany Bay, it depicted the adventures of exiled French aristocrats—a prince, a marquise, a baron. a judge, an abbé, and a banker—when confronted with the 'noble' savages of the Australian wilds, and held them all up to scorn as compared with a common labourer; it might be described as the 'Admirable Crichton' of the French revolution. Its supposedly Australian background bears, of course, no relation to fact.

Theatres and Productions.—The first dramatic performance in Australia was given on 4 June 1789 by a party of convicts, who staged 'The Recruiting Officer' in honour of the King's birthday. Their example was followed by soldiers and convicts both in Sydney and on Norfolk Island, and on 16 January 1796 the first Sydney theatre (erected by Robert Sidaway, an emancipist) was opened under the management of J. Sparrow with Young's tragedy 'The Revenge,' followed by an afterpiece 'The Hotel.' (The alleged 'Barrington' prologue, which is dealt with under that name, was not spoken on this occasion, being a mere *jeu d'esprit* written in England some years later.) The style and capacity of the theatre may be gauged by the price-list—boxes, 5s.; front boxes, 4s.; pit, 2s. 6d.; gallery, 1s., payment being made in money, flour, meat, or spirits. To procure these commodities and so obtain admission to the performances many petty thefts were committed, and Governor Hunter in 1798 closed the theatre and ordered the building to be pulled down. A second, established in 1800, had but a brief existence. For the next 30 years the settlement was dependent for its theatrical amusements on amateur performances, given sometimes by convicts, sometimes by regiments of the garrison, occasionally by visiting men-of-war; thus on 8 January 1830 the officers of H.M.Ss. *Crocodile* and *Zebra* performed 'Agnes, or the Bleeding Nun' and 'The Miller and his Men' in a marquee at Fort Macquarie. Sydney's first regular playhouse dates from 1832. In December of that year Barnet Levey, having obtained from Governor Bourke a licence 'for the production of pieces sanctioned by the Lord Chamberlain,' adapted for play-production a saloon at his George-street hotel, and performances were given there until the Theatre Royal, which was being erected at the rear of the hotel, was opened on 5 October 1833 with 'The Miller and his Men' and 'The Irishman.' This date marks the beginning of the continuous history of the Australian stage.

The company at the Royal during its early years was quite reputable. It included Conrad Knowles, a scholarly Shakespearian who later took over the management of the Melbourne Royal Theatre; Joseph Simmons, who after a brief managerial experience at the Royal became lessee of the Victoria Theatre, opened in 1838; Spencer, for some years regarded as the only tragedian in the country; Mrs. Taylor, the most gifted and versatile member of the company; and Eliza Winstanley (see O'Flaherty, Eliza), a native of Sydney, who afterwards joined Charles Kean's company at the Princess Theatre in London. Mrs. Chester of Drury Lane visited the Royal for a season in 1836. This house was closed on 22 March 1838; four days later the Victoria Theatre, a larger building erected in Pitt-street between

King- and Market-streets, was opened by Joseph Wyatt, who took over most of the company from the Royal, and in addition engaged some artists from Hobart. This theatre, long and affectionately known as 'the Old Vic.,' stood on the site since occupied by McCathie's drapery shop; just across Pitt-street was the Clown inn, kept for a time by George Coppin. The Victoria opened with 'Othello,' Arabin from Hobart playing the Moor, Spencer Iago, and Eliza Winstanley Desdemona. The usual round of tragedy, three-act drama, and burlesque was produced until March 1839, when a small French company gave a season of vaudeville, opera-bouffe, and French drama. In 1841 Dalle Casse, an acrobat who appeared for a short time at the Victoria, ran a circus under canvas in Hunter-street: this venture proving a failure, he converted it in 1842 into the Olympic Theatre, engaging as its manager Knowles, from the rival 'Old Vic.' Luckily for the older theatre the arrival of Francis Nesbitt McCron (who dropped his surname for theatrical purposes), and his success in a series of tragic and Shakespearian characters, warded off disaster. For Nesbitt was written the first play by a colonial author—'The Hibernian Father,' by Geoghegan, produced on 23 May 1844. The first star actor from the old country to appear on the boards of the 'Old Vic.' was, by his own account, George Selth Coppin (q.v.). In 1845 the theatre was occupied by a company that played grand opera three times a week, tragedy twice, and burlesque once; its prima donna was Theodosia Yates (playing as Yates Stirling), a descendant of the great Mrs. Yates of Garrick's days and the mother of Nellie Stewart (q.v.).

The only other town which at this time had a comparatively long theatrical tradition was Hobart. Before the opening of 'The Theatre'—later known as the Theatre Royal—in 1834 by a Mr. Cameron (who at the same time opened a makeshift theatre at Launceston), a Mrs. Clarke ran a company that played in a large room over a hotel at the corner of David- and Harrington-streets. In 1834 she occupied Cameron's theatre, and in 1840 brought from London an operatic company that performed grand opera there steadily for four years—a remarkable record. It included at one time or another Theodosia Yates (already mentioned), the singer Walter Sherwin, and the dancer Signor Carandini, for whom see CARANDINI, MARIE.

When this company went to Sydney, George Coppin had a successful season in Hobart before taking over the Olympic Theatre in Launceston on 3 March 1845; this was the first regular Launceston playhouse, Cameron's theatre being an upper room of the British Hotel. While in Launceston Coppin organized the company he took to Melbourne the same year—a good company including G. H. Rogers, a genial comedian who later proved himself versatile and accomplished, his wife, who was a sister of Charles Young, and Young and his wife. Rogers came to Hobart as sergeant in a line regiment, and displayed so much talent in amateur theatricals that Mrs. Clarke, the manageress and lessee of the Hobart theatre, bought him out of the service.

At Melbourne in 1841 a wooden pavilion was erected in Bourke-street in connection with the Eagle Tavern, but the magistrate refused a theatrical licence, so only musical entertainments could be given. The place, becoming disorderly, was closed by the police, but was re-opened in 1842 as the Theatre Royal. The first dramatic performance in Melbourne, given as a hospital benefit on 1 February 1842, under the management of George Buckingham, was 'The Widow's Victim' with an afterpiece 'The Lottery Ticket.' The Melbourne Royal was leased by Knowles of the Sydney 'Old Vic.' until 1844; it was then taken over by Cameron of Launceston, whose work gave it a recognized place amongst Australian playhouses. It was closed on 24 April 1845, three days after the opening of the Queen's Theatre, built by J. T. Smith in Queen-street, close to Little Bourke-street. For some months Coppin's company and the Melbourne company played at the Queen's on alternate nights.

In Adelaide Coppin built the first successful playhouse—Coppin's Theatre at Port Adelaide—in 1846 and, later, the Victoria in Currie-street. In Queensland and Western Australia the dramatic tradition is of later origin. The Brisbane school of arts hall, opened on 7 October 1851, was used occasionally for musical and dramatic productions—especially after it was moved to Adelaide-street, where it was successively known as the Bijou Theatre, the Albert Hall and the Gaiety Theatre. In 1856 an attempt was made by W. H. Ford from Astley's Amphitheatre, London, to run a theatre, but it was left to G. B. Mason to establish the theatrical business on a commercial basis by opening Mason's Theatre on 13 December 1865, despite considerable opposition. Soon afterwards the Royal Alexandra Theatre was opened by James Dinsdale, who arranged for the appearance of a 'dramatic and Shakespearean' company, starring J. L. Byers and Julia Hudson. On 21 April 1874 the Queensland Theatre (now the Theatre Royal) was opened, and on 2 April 1888 the Opera House, which is now His Majesty's Theatre. In Western Australia the Perth town hall was used for dramatic entertainments until the opening of the Cremorne Theatre in 1896, and of the Royal in 1897.

The impetus of the gold discoveries was felt in the dramatic as in other spheres of Australian life. The modern history of the drama on an Australian basis may be said to date from the fifties, when the chief Australian towns were visited by a distinguished group of English artists—the Starks, G. V. Brooke (q.v.), Fanny Cathcart, Waller and his wife, Laura Keene, Edwin Booth and William Hoskins. Hoskins, a comedian, during the next 30 years was continually before the Australian public as an actor-manager. The most notable of the group was Brooke; he first appeared in Melbourne at the Queen's Theatre under the management of Coppin. When, however, a portable iron theatre which had been constructed to his order in England (it was 88 feet long and 40 feet wide, and an interesting description of it will be found in the *Year Book of Facts* for 1855) reached Melbourne, Coppin erected it in Lonsdale-street, called it 'The Olympic,' and transferred Brooke to it. In 1856 he shifted the company again, to the Theatre Royal, whose owner had gone bankrupt. When the partnership between Brooke and Coppin was dissolved, Brooke stayed at the Theatre Royal, and Coppin went back to the Olympic, which had been used in the interim as a casino. In 1862 he opened the Haymarket Theatre, with Joseph Jefferson, the American comedian, as the 'star,' and it was to this theatre that he brought Charles Kean and his wife in the following year. The Keans (who were accompanied by James Cathcart, Fanny's

brother) were given a warm welcome by Shakespeare-lovers in Australia, though their best productions were equalled by those of Barry Sullivan (q.v.) who appeared at the Royal under the management of J. Hall Wilton. The sixties were rich in Shakespeare. The Keans were followed in 1866 by William Anderson, and by his contemporary Walter Montgomery, whose interpretation of Hamlet gave rise to a vigorous controversy in the Melbourne press on the subject 'Was Hamlet mad?' When in 1869 Montgomery appeared at the 'Old Vic.' in Sydney, he was supported by George Darrell, whose play 'The Sunny South' had a long run both in Sydney and London, and was the best of his many melodramas. By creating the character part of Babs Berkeley in 'The Sunny South' Essie Jenyns first attracted public notice.

Towards the end of 1874 J. C. Williamson and his wife, always affectionately known as Maggie Moore, visited Australia under the management of Harwood, Stewart, Hennings, and Coppin, and opened in Melbourne with 'Struck Oil,' which was an immediate success. In due course they departed, but in 1879 Williamson returned to Australia and undertook management on his own account. After another successful run of 'Struck Oil,' he introduced to Australia Robert Brough and Florence Trevelyan for his first season of Gilbert and Sullivan opera; his later productions during the eighties had Nellie Stewart as leading artist. Meanwhile Williamson had negotiated a partnership with Arthur Garner, a member of the London Comedy Company which opened in Melbourne on 15 March 1880, and with George Musgrove, a formidable rival who had produced with great success 'La Fille du Tambour Major.' So was formed the 'triumvirate'—one of the most powerful business partnerships in the history of the Australian stage. But the J. C. Williamson company did not dominate the Australian stage during the eighties and nineties as it does to-day. Musgrove after seven years terminated his connection with Williamson, and played his own company with Nellie Stewart as star. George Rignold (q.v.) and Alfred Dampier (q.v.) alternated Shakespeare with melodrama. On his second visit to Australia Rignold negotiated for the building of Her Majesty's Theatre at Sydney, which was opened on 10 September 1880 with a spectacular production of 'Henry V.' With Rignold was associated for a time Kate Bishop (mother of Marie Lohr), whose name is best remembered in connection with his stirring melodramas of the eighties. Rignold's chief melodramatic successes were 'In the Ranks' and 'Lights o' London.' For a long period Dampier staged a Shakespearian play every Friday evening in Sydney—his losses on Shakespeare being made up by his profits on melodrama. His most successful melodramatic production was 'Robbery Under Arms,' dramatized by himself and Garnet Walch from Rolf Boldrewood's novel. But the most brilliantly staged melodramas Australia enjoyed during this period were those of Bland Holt, son of the English actor Clarence Holt; for more than 20 years he produced melodrama on the Drury Lane scale, his work being continued on a less elaborate scale by William Anderson, a prominent figure since the sixties.

Of a higher quality were the productions of the Brough-Boucicault company. Robert Brough and Florence Trevelyan had won immediate popularity under J. C. Williamson's management; when they joined forces with the veteran dramatist Dion Boucicault and his son and daughter, who had been producing Irish plays for the Australian public, their success was assured. In 1887 the company took over the Bijou Theatre at Melbourne and the Criterion at Sydney, keeping the two houses open continuously until 1893. Their earlier productions were of burlesque but in 1888 they turned to good comedy, and for a number of years produced the many high-class plays that were being poured out by Arthur Wing Pinero, Henry Arthur Jones, and their fellows. Under the management of these various companies there appeared in Australia during the latter part of last century a long procession of distinguished actors, beginning with Ristori, the Italian tragedienne, in 1875 and Mrs. Scott Siddons in 1876, and culminating with the appearance of Sara Bernhardt as 'Camille' on 8 July 1891. Among other notable visitors from overseas may be mentioned Wilson Barrett (in 1898 and 1902), Julius Knight (who headed Williamson companies for several years), Cuyler Hastings and Nat Goodwin.

During the period under review the modern variety stage was developed in Australia by Harry Rickards (Henry Benjamin Leete). In 1872 Rickards—vocalist, comedian, and manager—first visited Australia; a second and third visit followed, and in 1893 he took over the Garrick, a theatre erected on the site of the old Tivoli which had been opened in 1868 as the Scandinavian Music Hall, and was for a long time the home of Hancock's Federal Minstrels. Rickards then proceeded to ally himself with managers in all the capital cities, this being a necessary preliminary to the introduction of stars from abroad. He practically controlled the variety stage in Australia until his death in 1911.

Early in the present century the Australian theatre (with the exception of the variety stage) passed under the domination of J. C. Williamson and Company. The period lacked dramatic incident until the organization of a rival company by Meynell and Gunn (later Meynell and Clarke), under whose management Oscar Asche and Lily Brayton opened their Australian tour in 1909. This competition led the older company to introduce H. B. Irving (whose Shakespearean productions were not very successful) and two grand opera companies. Meanwhile Meynell and Gunn secured Ethel Irving (who gave fine productions of 'Lady Frederick' and 'Dame Nature'), and arranged for a second visit from Oscar Asche and Lily Brayton. In 1911 the two firms joined forces. Another revival followed the formation of the theatrical firm of J. and N. Tait (previously concert directors) who introduced Sara Allgood, Emilie Polini, and Guy Bates Post to Australia during the war period; but after a few years of independence this firm in its turn joined the Williamson combination, and another opposition company—Hugh Ward leaving the Williamson firm to join Benjamin and John Fuller, who had previously been engaged in variety work—provided competition and so stimulated the production of popular entertainments. For the most part, however, this stimulus has resulted in an inrush of musical comedies and similar entertainments, though among visitors from England since the war have been Irene Vanbrugh (who first visited Australia with John L. Toole), the younger Boucicault (who had been the kingpin of the old Brough-Boucicault combination), Asche on a return visit, and Seymour Hicks.

Nor must the enterprise of Allan Wilkie be forgotten. For five years continuously he has presented Shakespeare to Australian audiences both in the cities and the smaller towns, recording his thousandth consecutive performance towards the end of 1924; in 1925 his work was rewarded with the grant of a C.B.E.

The Repertory stage.—The first Australian repertory theatre, established in Adelaide in 1908 by Bryceson Treharne as the 'Adelaide Literary Theatre,' grew out of a class formed for the study of dramatic literature in 1907. The name was changed to the 'Adelaide Repertory Theatre' in 1913. In spite of the vicissitudes of the war the society has paid its way from the start and during the 16 years of its existence about 150 plays have been produced. In 1911 Gregan McMahon, one of the ablest of Australian-born actors and probably the best of Australian producers, organized a repertory theatre in Melbourne which so flourished under the patronage of Lord Denman when governor-general that a building was specially erected for it. The war destroyed it, not by removing its audience but by depriving the producer of his best players; but during its seven years' career (1911-17) it was responsible for the production of 57 good plays, 13 of which were written by Australians. Post-war efforts to revive it under the name of the Mermaid Society have been successful, and the old name was resuscitated in 1924. Meanwhile McMahon, who had joined the Taits and moved to Sydney, at the end of 1920 organized a repertory theatre there, and in four seasons (1921-4) produced 24 good plays which would otherwise not have been seen in Australia, three of them being of Australian authorship.

Australian actors and plays.—Until the establishment of repertory theatres in Australia there was no training-school for local histrionic talent —apart from the commercial theatre, where success is hard-won. Nevertheless a number of native-born actors have achieved a local, and a few an international, reputation. Among the latter may be mentioned *Shiel Barry* (see DONOHOE, ANDREW), who after a brief theatrical experience with travelling companies in Australia went to England, where he played with great success. *Howard Vernon* (1845-1921), after making his debut on the Melbourne stage in light Italian opera, toured India and China with G. B. Allen, formed a company of his own which played the same circuit for 4½ years, and then sang in French and English comic opera in England and the United States. During his eastern tour he visited Tokyo in 1877, and was the first European actor to appear on a Japanese stage. In 1880 he returned to Australia to sing in comic opera rôles, and built up an enduring reputation as an interpreter of Gilbert and Sullivan opera, appearing in every play of the series from 'Pinafore' to 'Utopia Limited.' *Oscar Asche*, born at Geelong in Victoria in 1872, was trained for the stage in Norway, went to England in 1893, spent eight years with the Bensons, became manager of the Adelphi Theatre in 1904, and of Her Majesty's in 1907, and then toured the United States, South Africa and Australia (here under the management of Meynell and Gunn, producing Shakespearian plays only). In 1912 he toured Australia again under J. C. Williamson Ltd., producing Shakespeare and the Oriental play 'Kismet,' which he had already played with great success in England. After a tour of South Africa he returned to England in 1915 and the next year produced 'Chu-chin-chow,' famous for its uninterrupted run of nearly five years in London. In 1922 he again visited Australia, bringing a new Oriental drama, 'Cairo,' and reviving earlier successes in Shakespeare and Pinero. *Otto Peter Heggie*, born in 1880 at Angaston in South Australia, after a period of study at the Adelaide Conservatorium of Music, played in melodrama with Julius Knight and in comedy-drama with William Hawtrey; in 1907 he went to England, toured the United States with Ellen Terry, had parts in Shaw's 'Misalliance' and Galsworthy's 'Justice,' and in Shaw's 'Androcles' established his reputation firmly. Since 1913 he has been recognized as one of the six best English actors on the stage.

Of Australian actresses the best-known is *Nellie Stewart* (q.v.), who for many years played with Howard Vernon in Gilbert and Sullivan opera, and afterwards achieved equal success in melodrama of the 'Sweet Nell of Old Drury' type. Towards the end of last century *Essie Jenyns*, a step-daughter of Charles Holloway, began to build up a reputation in Mary Anderson parts, but married and left the stage. *Florence Young* of Melbourne succeeded Nellie Stewart as a comic opera favourite, and *Marie Lohr* and *Madge Titheradge*, though their training and their careers have been mainly English, are Australian by right of birth.

The first written plays published in Australia were three historical dramas and a farce which David Burn published in Hobart and dedicated to Lady Franklin in 1842. Of their production on the stage there is no record. Australian playwrights have so far received little local encouragement except from the repertory theatres, as managers find it more profitable to produce only such plays as have had a successful run in London or New York. A few Australian plays have been produced in London, among them George Darrell's 'The Sunny South' (1884), Alfred Dampier's adaptation of 'Robbery Under Arms' (1894), and Bert Bailey's 'On Our Selection' (1920). Two of these are melodramas, the third a farce. Haddon Chambers (q.v.), though technically an Australian dramatist, spent his adult life in England and never used an Australian setting for his plays. The first Australian-born dramatist to achieve London production was Norman McKeown, whose 'Travellers' was put on by the Stage Society in 1912. Arthur Adams, a New Zealander whose life has been mainly spent in Australia and England, has to his credit the production in 1917 of 'Mrs. Pretty and the Premier' by Arthur Bourchier at His Majesty's Theatre; this play was first staged at the Melbourne repertory theatre. Among plays published but not yet commercially produced may be mentioned those of Montague Grover, Louis Esson, Helen de Guerry Simpson, and George S. Beeby.

J. F.

Draper, DANIEL JAMES (1810-1866), born at Wickham in Hampshire on 28 August 1810 and trained for his father's trade of carpentering. In 1830 he joined the Methodist Church, in 1834 was appointed a minister, and in October was sent to Australia as a missionary. Reaching Sydney on 3 April 1835, he worked for 10 years in New South Wales, in 1846 was made first superintendent of the Adelaide circuit, and in 1855 was transferred to Victoria. In all three colonies his activity was remarkable, and he was responsible for the erection of very many churches and school-houses. Having visited England in 1865 for his health's sake, he em-

barked in the s.s. *London* on 5 January 1866, and was drowned—together with Dr. Woolley, G. V. Brooke, and nearly 250 other passengers—when the vessel went down in the Bay of Biscay on the 11th. A 'Draper Memorial Church' was erected in his honour at Adelaide.

'Dreadnought' Funds. See MIGRATION.

Drongo, Spangled (*Chibia bracteata*), the sole representative in Australia of the drongo family (Dicruridae), members of which are numerous in southern Asia, and occur also in Africa. The spangled drongo is a glossy black bird, with deep metallic green wings and tail, and

Spangled Drongo.

green spots on the feathers of the head and breast; the tail is long, somewhat forked, with the outer pair of feathers recurved. It is common in the north of Australia and New Guinea, and occasionally extends southwards in summer along the east coast to Victoria—even to Tasmania. It is active and noisy; its usual note is a loud harsh cackle, but it also mimics other species. Its food consists mainly of insects. When nesting, it is extremely bold and pugnacious, driving away hawks and crows from the vicinity. The nest, composed of the dry, wiry stems of climbing plants, is an open cup-shaped structure placed at the extremity of the branch of a large tree. The three or four eggs are white, with dark spots.

W.B.A.

Drosera. See SUNDEW.

Drum-head. See GRASS-TREES.

Drummer, fishes of the genus *Kyphosus*. The Silver Drummer (*K. sydneyanus*) is common round rocky reefs in the neighbourhood of Sydney during the warmer parts of the year, when the rocks between tide-levels are covered with a brown seaweed (*Wildemania*) upon which it feeds. When this dies off during the winter months, most of the drummer likewise disappear, perhaps migrating into deeper water, though young examples are occasionally taken throughout the year. They also feed upon shell-fish and crabs, but are so fond of the weed that, if handfuls of it be thrown into the water, they will rise to it with avidity and partly expose themselves above the surface. They are captured by line-fishermen with hooks baited with the seaweed, but most of those marketed are caught in nets. The silver drummer attains a length of over 30 inches; small specimens are tasty table-fish, but the larger examples are almost worthless as food unless specially treated. It ranges from New South Wales to south-western Australia and New Zealand.

Other species of *Kyphosus* occur in our tropical waters, and one (*K. cinerascens*) is known as 'bream.' All have the head, body, and much of the fins covered with stout scales, and, in conformity with their weed-eating habits, the outer row of incisors in each jaw is modified to form cutting teeth. The Rock Blackfish (*Girel'a*) also is known as 'black drummer' round Sydney.

A.R.McC.

Drummond, JAMES (1787-1863), born in Perthshire, brother of the botanist Thomas Drummond who discovered the well-known *Phlox Drummondi*, is first heard of as curator of the botanical gardens at Cork, Ireland, in 1809. In 1829 he accompanied Captain James Stirling (q.v.) to Western Australia as botanist, naturalist and 'superintendent'—probably of agricultural operations. He took up land on the Swan and Helena rivers near Guildford, devoting part of his time to the curatorship of a botanical garden on what is now Stirling Square in Perth. He also took up a large area of land near Toodyay (on the Swan about 60 miles NE. of Perth) and devoted much attention to fruit-growing there. His interests, however, were concerned with discovering new plants rather than fostering gardens, and he occupied himself mainly with long journeys across country, as far as King George's Sound in one direction and the Murchison River in the other. His discoveries were naturally many and of great value, and his name is attached to over 100 species of plants endemic in Australia. In 1839 he commenced to prepare sets of Western Australian plants for sale to European collectors and gardens; six series in all were issued, and one set of each series placed in Kew Gardens near London. He died at Hawthornden near Toodyay on 27 March 1863. The date of his birth is uncertain. In Stirling's muster-book of 1829 he is entered as 42 years old, which makes his birth-year 1787; but at his death he was reputed to be 79, which would imply his birth in 1783-4. His fourth son, Johnston Drummond, born in 1820, collected birds for John Gould (q.v.) and while doing so was killed by aborigines in 1846.

Dry, SIR RICHARD (1815-1869), born near Launceston in Tasmania on 15 June 1815, was the son of Richard Dry, one of the Irish Exiles (q.v.), who from 1805 to 1818 was so excellent a storekeeper at Port Dalrymple that when he retired in 1819 Macquarie gave him 500 acres and a year's victualling from the government stores. At this time he had 7000 sheep and nearly 400 cattle—'a very large fortune' said Macquarie approvingly—for the maintenance of which the grant was made. The son, educated at Campbelltown in Tasmania, managed his father's estates until in 1844 Eardley-Wilmot nominated him to a seat in the old council; here he fought the governor strenuously on the question of loading the colony with the cost of the convict system, and led the 'patriotic six' non-official councillors who, resigning in 1846, brought about Eardley-Wilmot's downfall. Reinstated

in 1848, he next attacked the whole system of transportation; and, when in 1851 Tasmania acquired a representative form of government, he was elected for Launceston amid great popular enthusiasm. On 30 December of that year he was chosen speaker of the new council, retiring in 1855 on account of ill-health; after a visit to England, from which he returned in 1860, he was in 1862 elected to the council as member for Tamar, and on 24 November 1866 formed a ministry which he led until his death on 1 August 1869. A man of great tolerance and tact, he was probably the most popular politician ever known in Tasmania. (Kt. Bach., 1858.)

Dryandra, a genus of the family Proteaceae, consisting of shrubs, often prostrate or flowering near the base, endemic in Western Australia. The flowers, usually yellow, are in pairs in dense heads within a series of bracts, and usually surrounded by a ring of leaves similar to the stem-leaves; corolla usually straight, with a slender tube, the lobes separating as the tube opens or (rarely) remaining coherent; fruit a compressed capsule, opening at the dilated margin in two leathery, or almost woody, valves; seeds compressed, with a terminal membranous wing, broad and rounded like the valves.

Duboisia, a genus of the family Solanaceae, consisting of shrubs or trees with small flowers and succulent fruits. *D. myoporoides* (Corkwood) ranges from New South Wales into Queensland, and extends to New Caledonia. According to Dr. Woolls (quoted by Maiden in *Useful Native Plants*), this tree 'has an intoxicating property. The aborigines make holes in the trunk and put some fluid in them, which, when drunk on the following morning, produces stupor. Branches of this shrub are thrown into pools for the purpose of intoxicating the eels and bringing them to the surface.' The timber is white to yellowish, close-grained and firm, though soft when green; it is used for carving and wood engraving. The bark resembles that of the Cork Oak (*Quercus suber*) of commerce. *D. Hopwoodi*, the *pituri* plant, an inland species, is endemic in Australia. The aborigines of central Australia masticate its leaves when more or less powdered and mixed with finely broken twigs. So fine is the powder, and so irritating, that even the most careful handling is accompanied by sneezing. The trees are patchy in distribution, but the blacks travel enormous distances to procure it, and it has become a valuable commodity in tribal barter. The tops and leaves are gathered in August, when the plant is in blossom, and hung up to dry, then packed in netted bags or skins for transport. Sometimes *pituri* is chewed in company, a quid being passed from one to another. It is also smoked; for this the leaves are damped, mixed with potash prepared from the ashes of plants, and rolled up in the shape of a cigar. In small quantities it has a powerful stimulating effect, assuaging hunger, and enabling long journeys to be made without fatigue and with little food. The blacks use it to excite them before fighting, and to poison emus. *D. Leichhardti* is also endemic and limited to the eastern States, chiefly Queensland. Recent investigations show that all three species contain atropine, hyoscyamine and other mydriatic alkaloids. See BANCROFT, JOSEPH.

Du Cane, SIR CHARLES (1825-1889), born in 1825 at Ryde in the Isle of Wight, was educated at Charterhouse and Exeter College, Oxford (B.A., 1847; M.A., 1864). Entering politics as conservative member for Maldon (Essex) in 1852-3, he represented North Essex in the house of commons from 1857 to 1868, during the last two years of his term being a civil lord of the admiralty. In December 1868 he was appointed governor of Tasmania, reached the island on 12 January 1869, and served until 28 November 1874. During this time the colony prospered greatly; gold and other metals were discovered, railways were built, and the submarine cable across Bass Strait linked Tasmania up with the mainland. Returning to England at the end of 1874, Du Cane was in 1875 placed on a royal commission to investigate the working of the factory acts. In 1878 he became chairman of the board of customs, and retained the post until his death on 25 February 1889. (K.C.M.G., 1875.)—A cousin, SIR EDMUND FREDERICK DU CANE (1830-1903), a notable reformer of prison conditions in Great Britain, was from 1851 to 1856 employed in Western Australia to organize convict labour on public buildings. He was recalled for service in the Crimean war, but did not reach England till it was over. From 1856 to 1863 he designed harbour defences at Dover and Plymouth, and from 1863 onwards was director of convict prisons, inspector of military prisons, and (from 1873) chairman of the prison commissioners. Born at Colchester on 23 March 1830, he died in London on 7 June 1903. T.D.

Duckett, SIR GEORGE (1725-1822), son of George Jackson of Richmond in Yorkshire, born on 24 October 1725, entered the navy office about 1743, was made secretary to the navy board in 1758, and second secretary to the admiralty on 11 November 1766. From 1766 to 1768 he was member for Weymouth in the British parliament. In 1782, having been implicitly censured by the house of lords for irregular procedure in connection with a court martial, he left the admiralty (becoming simply judge-advocate of the fleet), and in 1788 and 1791-6 was member for Colchester. In 1797 he assumed the name of Duckett by royal licence to conform with the conditions of a bequest from his second wife's uncle. He died in London on 15 December 1822.

His connection with Australia results from his long-continued patronage of James Cook, who began life as a stable-boy on the estate of Jackson's sister at Ayton in Yorkshire; it was probably his influence with Lord Sandwich that gave Cook command of the *Endeavour*, and Cook recognized his help by naming after him Port Jackson in New South Wales and Point Jackson in New Zealand. The fact that Jackson afterwards changed his name allowed his eponymity to drop out of sight, and a legend arose (and was believed by Dr. Lang) that Port Jackson had been named after a seaman who sighted it from the *Endeavour's* masthead. As there was no one of the name of Jackson in the *Endeavour's* crew, this explanation is obviously impossible. Duckett's claim to be the godfather of Sydney harbour rests on (*a*) a specific statement to that effect on his tombstone in the church at Bishops Stortford, England, (*b*) the indirect evidence that Points Jackson and Stephens in Admiralty Bay, New Zealand, were according to Cook's own journal named after the then joint secretaries of the admiralty, and that shortly after naming Port Jackson in New South Wales Cook named Port Stephens, thus a second time associating the two men. (Bart., 1791.)

Ducks and Geese, aquatic birds belonging to the order Anseriformes, found throughout the world and represented in Australia by 18 species. Though most of the members of the order may be readily classed as geese or ducks, certain forms are so nearly intermediate that it is usual to regard them all as members of the single family Anatidae, which also includes the swan (q.v.).

Australian geese are of peculiar types. The Cape Barren Goose (*Cereopsis novaehollandiae*), a gray bird with a wax-yellow shield above the

Cape Barren Goose.

beak, was first discovered in 1792, when the French naturalists of d'Entrecasteaux's expedition in search of La Pérouse found it on the islands of the Recherche Archipelago in Western Australia. It derives its popular name from Cape Barren Island, one of the Furneaux group in Bass Strait, where—as in many other islands off the southern coast of Australia—it is found in numbers; although webfooted, it is never seen on the water, but feeds on the island grasses and herbage. When these dry up, it migrates to the mainland of Australia or Tasmania to feed, but always returns to the islands to breed.

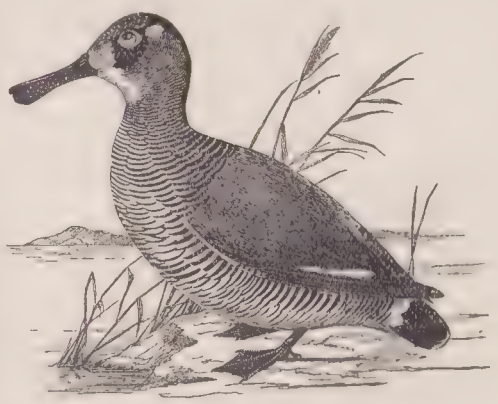
The Magpie Goose (*Anseranas semipalmata*) was formerly found throughout northern and eastern Australia, but is now almost extinct in the settled districts of the south-east. The webs of the feet only extend a short distance along the toes, leaving the extremities of the latter free.

Two species of Pygmy Geese or Goose-teals (*Cheniscus*) occur in Australia, one in the north and the other in the east. Though true geese in form, they are smaller than teal.

Maned Goose.

The Maned Goose or Wood Duck (*Chenonetta jubata*)—which is, as its alternative names imply, intermediate between geese and ducks—is widely distributed throughout Australia and Tasmania, and must be regarded as another of our peculiar endemic Anatidae.

Of the Australian ducks the commonest—and most sought after by sportsmen—is the Black Duck (*Anas superciliosa*), which occurs also in New Guinea and New Zealand; it is nearly allied to the wild duck of the northern hemisphere (*A. boschas*), from which our domestic ducks are derived, and with which it readily interbreeds in confinement. It is, however, remarkable that in the black duck the sexes are alike, both resembling the female of the northern species, whilst in *A. boschas* the drake assumes brilliant colours in the breeding season. Other well-known Australian ducks are the two species of Teal (*Virago*), the Blue-wing or Shoveller (*Spatula rhynchotis*), the Mountain-duck or Sheldrake (*Casarca tadornoides*), and the Hardhead or White-eyed Duck (*Nyroca australis*), all members of genera widely spread throughout the world. But three Australian ducks are sufficiently peculiar to be regarded as generically distinct from anything found elsewhere. These are the Freckled Duck (*Stictonetta naevosa*), a rare species generally found sparingly in flocks of other ducks; the Pink-eared Duck (*Malacorhynchus membranaceus*), a species the size of a teal, with a very wide shovel-shaped bill; and



Pink-eared Duck.

the Musk Duck (*Biziura lobata*). The last was first met with by Vancouver in 1791, in King George's Sound in Western Australia. He notes in his journal that 'though ducks were in great numbers, we were very unsuccessful in taking them. A very peculiar one was shot, of a darkish-grey plumage, with a bag like that of a lizard hanging under its throat, which smelt so intolerably of musk that it scented nearly the whole ship.' The 'bag' mentioned by Vancouver is a membranous flap projecting from the chin, which in old males attains a large size; its use has not been ascertained. The musk duck is plentiful on swamps, rivers and inlets of the sea throughout southern Australia and Tasmania. When pursued it takes refuge in diving—very few persons have ever seen a musk duck flying. It can, however, fly strongly, but rarely does so except at night, when travelling from one swamp to another.

Dudley, Earl of. William Humble Ward, 2nd Earl of Dudley, born on 25 May 1867 and educated at Eton, succeeded his father in the earldom in 1885 and from 1895 to 1902 was parliamentary secretary to the board of trade, serving during that period with the yeomanry in South Africa (1899-1900). From 1902 to 1906 he was lord-lieutenant of Ireland; in 1906-8 chairman of a royal commission on congestion in Ireland; from 1908 to 1911 governor-general of Australia—and took great interest in the discussions that determined Australia's contribution to Imperial defence. In 1915 he commanded the Worcester yeomanry on the Gallipoli peninsula, and later on was commandant at Mudros, while in 1916 he was attached to the headquarters staff of the 40th division. (G.C.V.O., 1903; G.C.M.G., 1908; G.C.B., 1911.)

Duelling. For fifty years after Australia was first settled the duel was still in Great Britain a recognized mode of settling a quarrel, and the leading men of the distant colony conformed to the custom. Indeed, it survived in Australia after it was extinct in Britain, for the last duel fought in England took place in 1845, the last in Ireland in February 1851, and the last in Australia in September 1851.

Three Australian duels are of some historical importance. On 10 September 1801 William Paterson, then in command of the New South Wales Corps, challenged his junior officer John Macarthur for having divulged and misinterpreted Paterson's private communications to him. On the 14th they met near Parramatta, and Macarthur, obtaining first fire, wounded Paterson in the right shoulder so severely that the colonel was rendered unable to fire in his turn. Governor King promptly had Macarthur arrested, together with the seconds, Captains Piper and McKellar; Macarthur demanded a court martial, and King—knowing that feeling ran so high among officers of the corps that an impartial trial by them was impossible—sent him to England to be tried there. The full story of the duel will be found in vol. iv of the *Historical Records of New South Wales.* Only King's intervention prevented a duel between Piper (Macarthur's second) and McKellar.

Between 1801 and 1826 public feeling about duelling had begun to change, and the duel between Saxe Bannister and Robert Wardell was an extremely inconspicuous affair. Wardell, as editor of *The Australian* (a newspaper opposed to Darling and his officials), on 18 October 1826 made a bitter attack on Bannister, who had just resigned the attorney-generalship. The attacked man asked Darling to prosecute the offender; Darling refused, since Bannister was no longer an official; and Bannister promptly challenged Wardell. They met at Pyrmont on 21 October, exchanged shots that hurt only their clothing, and were then persuaded off the field by their seconds. It is noteworthy that, whereas King had filled many pages of foolscap with the details of the Macarthur duel, Darling does not appear to have mentioned the later one. Writing on 1 November, he merely says:—'I might add that the rancour of the Editor and Mr. Bannister against each other appears unparalleled.'

The third duel, 25 years later, created a much bigger sensation. In September 1851 Stuart Donaldson—who had been for three years an elected member of the legislative council of New South Wales, but was at the moment a candidate for election—attacked the government of the day for extravagance and cited as an example over-expenditure in the surveyor-general's department. Sir Thomas Mitchell, who was head of the department, attacked Donaldson in the *Sydney Morning Herald,* and after much bickering the offender declared that he was blaming the whole system of land administration, not the surveyor-general's department in particular. This failed to appease Mitchell, who sent a friend to him to arrange a duel. On the 27th the two met in the bush near what is now Centennial Park, Sydney; each fired three shots, Mitchell's last going through Donaldson's high hat; and the seconds then put an end to the fight.

Two duels that did not take place may be recorded. In 1844 Robert Lowe (see Sherbrooke, Lord) was challenged by Henry McDermott, an alderman of Sydney, but merely brought the challenger into court and had him bound over to keep the peace. In 1849 Lowe was in trouble again—his bitter tongue, indeed, would in earlier days have brought him into many duels. Wentworth's first (1849) bill for the incorporation of a university at Sydney included a clause appointing William Bland, among others, to the university senate. In committee of the council on 5 October the bill was 'counted out;' when on the 10th Wentworth moved to recommit it, Lowe attacked it for allowing an ex-convict to become a senator. On the 11th Bland wrote to Lowe a letter which is now in the Mitchell library, not challenging him in set terms ('I am recommended not to call upon you for the satisfaction of a gentleman, because you have on more occasions than one . . . . in a manner the most cowardly evaded it'), but merely calling him a coward and a scoundrel if he did not fight. Lowe attempted to prosecute Bland for 'inciting deponent to commit a breach of the peace,' but the judges decided that there was not sufficient evidence of incitement—apparently thinking that no insults could incite Lowe to a breach of the peace—and the affair ended.

Duelling in India provided Australia with at least two good colonists—George Bridges Bellasis and William Bland. Bellasis in May 1801 killed the man who had jilted his sister-in-law and slandered the Bellasis family; on 18 July he was sentenced at Bombay to 14 years' transportation; on 2 January 1802 he reached Sydney in the E.I.C. cruiser *Fly,* and was at once conditionally pardoned by King and appointed on 14 October lieutenant of artillery with charge of the fixed defences of the colony, succeeding Francis Barrallier. In November 1803 he received a full pardon, and returned to India. For Bland's duel see Bland, William.

Duff, Sir Robert William (1835-1895), born at Fetteresso in Kincardineshire on 8 May 1835 and educated at Blackheath, entered the navy in 1848 (sub-lieutenant, 1854; lieutenant, 1856; commander, 1865), but took up politics in 1861, and from that year to 1893 was liberal member for Banffshire. From 1882 to 1885 he was liberal whip, and in the short Gladstone ministry of 1886 was a junior lord of the admiralty. In 1892 he was made a privy councillor for long-continued and unostentatious services both to his party and to the country. On 23 February 1893 he was appointed to the governorship of New South Wales, and used his wide knowledge of parliamentary practice to solve several difficult situations due to the impetuosity of his premier, Sir George Dibbs. His

term of office was troubled in several ways, and on 15 March 1895 he died at Sydney. His surname at birth was Duff-Abercromby; but he discontinued the use of the latter portion in 1870 on succeeding to the ownership of the Fetteresso estate. (G.C.M.G., 1893.)

Duffy, Sir Charles Gavan (1816-1903), born in county Monaghan, Ireland, in 1816 and educated at Belfast, in his 20th year became subeditor of the Dublin *Morning Register*, three years later owned and edited the Belfast *Vindicator*, and in 1842 returned to Dublin to join John Dillon and Thomas Davis in starting the *Nation* as the organ of Young Ireland. Working with O'Connell 'the Liberator,' he was convicted of sedition in 1844 (but escaped on a technical point), founded the Irish Federation in 1846, was arraigned four times for treason-felony in 1848-9 (the juries always disagreed), and in 1852 revived the *Nation* (which had been suppressed), helped to found the Tenants' League (an organization in which Ulster Protestants and Catholics from the south of Ireland worked side by side), and was elected to the British parliament as a member of the Independent Irish party. When that party broke up in 1855, Duffy left parliament in disgust and migrated to Victoria, reaching Melbourne in January 1856.

By this time he enjoyed a great reputation in politics. Latrobe, Robert Lowe, and the Howitts had combined to praise Australia to him and him to Australia. He was hailed by the large body of Irish colonists as their destined leader; O'Shanassy at the head of a eulogistic deputation boarded the vessel that brought him out, and Henry Parkes and Dr. Lang tried to secure him for Sydney. But Duffy preferred Victoria, where his admirers bought him an estate and had him elected to the legislature by a far western constituency. This was the first legislature under responsible government, and Duffy, in close alliance with O'Shanassy, soon made himself prominent; within four months of the opening the two took office for a turbulent six weeks (March-April 1857), were ejected, fought their successors bitterly for another ten months, and on 10 March 1858 resumed office under the nominal leadership of H. S. Chapman. The burning questions at this time were connected with (*a*) extension of the franchise and (*b*) the disposal of crown lands; on both questions Duffy and his colleagues were for radical reform—adult franchise, breaking up the big estates leased to squatters. But before the end of 1859 O'Shanassy and Duffy had parted company, probably because the latter was vain and inclined as a former member of the British parliament to patronize colonial legislators; and the ministry, though it carried its franchise proposals, failed to pass any land legislation and was rejected by the new parliament that met in October. For two years Duffy was in opposition, but on 14 November 1861 again took office as minister for lands under O'Shanassy, with whom a reconciliation had been patched up. During the next 19 months he succeeded in passing a land act that was a genuine but ill-considered attempt to place farmers on soil suitable for farming; but the consequent revaluation of squatters' runs proved disappointing, and caused the downfall of the ministry. During the term of the McCulloch ministry which followed—and which held office with one slight intermission for over six years—Duffy visited Britain, but in 1867 returned, became member for Dalhousie, and by persistent attacks drove McCulloch from office in September 1869, though refusing to replace him. The treasurer of the next ministry was Graham Berry (q.v.), whose protectionist views were gaining great popularity; and, when in June 1871 Duffy at last saw his way to the premiership, he at once took in Berry as treasurer and identified himself with the supporters of a high tariff, adding of his own accord a proposal for progressive land taxation. Carrying the first proposal and losing the second, he was ejected from office in the following June on a charge of favouring his fellow-countrymen and co-religionists when making official appointments. By now he was ageing after a strenuous career, and never held office again; when the protectionists again came into office it was Berry who led them, and Duffy went off to England once more. Returning in 1877, he declined to serve under the now repentant Berry, but was made speaker of the assembly. In 1878 he refused (after dallying with it) Berry's offer to take him on the famous 'embassy;' at the end of 1879 he resigned his position and retired from politics, returning to Europe next year and for the rest of his life residing in the south of France. From this retreat he poured out a succession of volumes on Irish history and articles on colonial and Irish politics, followed in 1898 by an autobiography, *My Life in Two Hemispheres*. He died at Nice on 9 February 1903. (Kt.Bach., 1873; K.C.M.G., 1877.)

His eldest son, John Gavan Duffy (1844-1917), born at Dublin on 15 October 1844 and educated at Stonyhurst and the university of Melbourne, was for many years prominent in Victorian politics, being minister for lands under Service (March to August 1880), postmaster-general under Munro (November 1890 to February 1892), attorney-general for two months under Shiels (February to April 1892) and postmaster-general again under Turner (September 1894 to December 1899). He represented Victoria on the federal council of 1893 and at the premiers' conference of 1896. He died on 8 March 1917. The second son, Frank Gavan Duffy, born in Dublin on 29 February 1852, is a justice of the federal high court; and the third, Charles Gavan Duffy, born in Dublin on 27 August 1855, entered the Victorian public service in 1871 as private secretary to his father, then premier, was made clerk assistant of the Victorian assembly in 1891, clerk assistant in the federal senate in 1901, transferred to the clerkship of the house of representatives in July of the same year, and in February 1917 returned as clerk to the senate. He retired from the public service in August 1920. (C.M.G., 1904.)

Dugong, vernacular name of a genus (*Halicore*) of marine mammals of the order Sirenia, inhabiting certain areas in the Indian and Pacific oceans and waters connected with them. The separation of the Australian dugongs, as a species distinct from those which inhabit the Indian Ocean and Red Sea on the one hand and the coast of East Africa on the other, has never been justified by the production of any constant differences, either in external features or anatomical structure. In the absence of any evidence of such differences, all existing dugongs must be regarded (at least provisionally) as members of one species. For this Gmelin's specific name, *H. dugong*—given in 1788—is to be preferred by virtue of priority over the other names (*H. australis, H. tabernaculi*) that have been proposed. On Australian

coasts the dugong is at the present day almost confined to the tropics, though ranging from Moreton Bay on the east to the neighbourhood of Broome on the west. On the evidence of an incomplete skeleton, found at a depth of a few feet during the excavation of the canal at Shea's Creek near Botany Bay, it is concluded that the dugong's southward range was more extensive in the past; further evidence in the same direction has been supplied by the discovery of isolated bones at the Macleay River. About 1894, too, a complete specimen is said to have been obtained at Broken Bay. But a much earlier record is the statement of Collins (*Account of the English Colony in New South Wales*, p. 409) that in March 1795 'some of the head bones of a marine animal,' which Paterson said were those of a manatee, were found 'to the southward of Botany Bay.' As the manatee occurs only in the Atlantic, these must have been bones of the allied mammal, the dugong.

The food of the dugong consists, not of algae, as is sometimes stated, but of the roots of certain monocotyledonous plants (*Posidonia, Zostera*) with blade-like leaves ('sea-grass') that give rise to marine 'meadows' on sheltered flats covered with a mixture of sand and mud, and extending from about low water to a depth of several fathoms.

The dugong is a gregarious animal, herds of from 6 to 40 being common; it is recorded that in July 1893 a herd seen in Moreton Bay extended over a length of nearly three miles by a width of 300 yards. The females in any herd always outnumber the males. Aborigines hunt the animal for food, Europeans (who in northern waters employ aborigines, farther south do their own hunting) for the sake of (*a*) the oil contained in the internal fat, which has medicinal value, especially for lung complaints, (*b*) the hide, which when well-tanned makes excellent leather, and (*c*) the bones, which are said to make the best charcoal for sugar-refining. In Moreton Bay and Wide Bay capture is effected by means of strong coir nets of at least 3-ft. mesh (measured diagonally), usually 360 feet long and about 26 feet deep: these are set at low tide at a sharp angle across gutters on the feeding-grounds. The winter months (June, July, and August) form the netting season. Farther north the aborigines follow the dugong in bark canoes, and spear it with heavy harpoons: in the far north—Torres Straits and the waters east of the Cape York peninsula—a light wooden staging set up in places where the animal has been seen to feed is often used instead of a canoe. Among the northern tribes females are strictly forbidden to look at a dugong until it has been cut up, but in southern Queensland this *tabu* no longer exists.

The dugong, as far as is yet known, bears one baby a year. The baby is about three feet long when born, and is suckled through a nipple two inches long situated just beneath the flapper on each side. The mature animal is from 1000 to 1200 lb. in weight, and a specimen caught in Moreton Bay measured 11ft. 8in. from snout to tail; eight to ten feet, however, is a more usual length. A well-grown dugong yields four to five gallons of oil; its hide when green weighs nearly 200 lb.; and the flesh, if treated like pork or bacon, is extremely savoury and digestible.

See A. W. Scott's *Mammalia, Recent and Extinct*, and W. Saville Kent's *Great Barrier Reef of Australia*.

W.A.H.

Dumaresq, HENRY (1792-1838), the eldest of three brothers—descendants of an old Jersey family (the name is pronounced 'Dumarrick' or 'Dumerrick')—who migrated to Australia when their brother-in-law General Darling was made governor. Henry was educated at the royal military college, entered the army at the age of 16 (lieutenant, 1808; captain, 1813; brevet-major, 1815; lieutenant-colonel, 1817) took part in six battles of the Peninsular war, and served on Wellington's staff at Waterloo. He was Darling's military secretary during his administration of the Mauritius (1819-24) and was sent ahead of him to Australia. Reaching Sydney on 13 October 1825, he first busied himself in making the Sydney government house fit to live in (Brisbane had lived at Parramatta), and on 21 December became Darling's private secretary, a post which he held with one intermission until 1831. In 1826-7 he was clerk to the executive council, but in June of the latter year was sent to England with despatches, met the directors of the Australian Agricultural Company (in which he had become interested through the Macarthurs), and impressed them so favourably that at a later date they chose him to succeed Sir E. Parry as commissioner in Australia. He took over the position on 19 March 1834, and proved so efficient that the directors raised his salary and proposed to extend his term of office; but on 5 March 1838 he died at Port Stephens of an apoplectic stroke. From 1831 to 1834 he seems to have lived on his estate at St. Helier's near Muswellbrook on the Hunter River.

WILLIAM JOHN DUMARESQ, the second brother, was educated at the military college, joined the army in 1808, fought through the Peninsular war and the Waterloo campaign, and rose to be a captain in the Royal Staff Corps. Coming to Australia with Darling in 1825, he was made provisionally civil engineer for the colony and (a little later) inspector of roads and bridges, and was recommended for appointment as deputy-surveyor-general; but the British authorities had another man in view for that post, and Dumaresq refused a permanent appointment as civil engineer, though he continued for some time to discharge the duties of that post, and was instrumental in procuring the adoption of the Sydney water-supply scheme devised by John Busby (q.v.). In 1829 he was for a short time acting colonial treasurer and in 1829-31 a member of the land board, but retired into private life in 1831 and settled at Invermein near Scone. He also leased 65,000 acres at Tilbuster, which with Henry Dumaresq's 100,000 at Saumarez completely enclosed Armidale. When elected members were admitted to the legislative council, he represented his district as long as that council lasted (sitting for the counties of Hunter, Brisbane and Bligh in 1843-8, and for Phillip, Brisbane and Bligh in 1851-6), and was nominated to the non-elective council of 1856, but resigned almost immediately. He died at Cleveland in Queensland on 9 November 1868.

EDWARD DUMARESQ (1802-1906), the third brother, was also educated at the military college, and obtained a commission in the engineers; afterwards he served for five years in the survey department, East Indies. By virtue of this experience he was put in charge of the Tasmanian surveyor-general's department by Darling when he called at Hobart on his outward voyage in December 1825. Arthur,

who formed a high opinion of him, confirmed Darling's choice, and further made him a member of the land board and chief commissioner for the survey and valuation of lands. One of his reports stated that New Norfolk should have been the capital of the colony, since it was far more conveniently situated than Hobart for communication with the rest of the island, but admitted that the transfer was at that late date impossible. In 1829 he left the survey office, the British government having never confirmed the appointment and having made a new choice; in 1830 he was made police magistrate at New Norfolk, but in 1833 moved to Longford, and died there on 23 April 1906 at the age of 104. The Dumaresq river in northern New South Wales was so named by its discoverer Allan Cunningham, not after any particular member of the family, but 'in honour of the family to which His Excellency the Governor is so intimately connected.'

Dumaresq, JOHN SAUMAREZ (1873-1922), grandson of W. J. Dumaresq (see DUMARESQ, HENRY), was born at Sydney on 26 October 1873 and named Saumarez either from the old family estate in Jersey or after Sir James Saumarez, under whom a great-uncle served during the Napoleonic wars. Following the example of several ancestors, and an uncle (A. F. C. Dumaresq, son of Henry), he in 1886 entered the navy (lieutenant, 1894; commander, 1904; captain, 1910; commodore, 1919; rear-admiral, 1921). Specializing at first in torpedo work, he later on invented instruments for improving gun-fire control and for determining the rate of movement of enemy ships which proved invaluable in war. At Jutland he commanded H.M.S. *Shannon,* but in 1917 transferred to H.M.A.S. *Sydney,* then cruising in the North Sea, and for a considerable time acted as senior officer of the 2nd light cruiser squadron; he was largely responsible for the carrying of aeroplanes in light cruisers, the first revolving platform being made to his design and fitted in the *Sydney* in October 1917. On 21 March 1919 he was appointed to the command of the Australian fleet, and devoted himself energetically to building up again the efficiency and esprit de corps of a squadron which had during the war been scattered all over the world; and to the last day of his command he protested vigorously against the severe reductions in strength which for political reasons were thought necessary. At the end of his three years' term he hauled down his flag, intending to return to England. On the way, however, he became seriously ill, and died at Manila on 22 July 1922. (M.V.O., 1908; C.B., 1916; C.V.O., 1820; Naval A.D.C. to the King, 1921.)

Dunbar, Wreck of the. On 31 May 1857, the ship *Dunbar,* 1321 tons register, 1980 tons burthen, left England under command of James Green, with 63 passengers and a crew of 59, all told, carrying a full general cargo for Sydney.

Between 7 and 8 p.m. on 20 August she very slowly passed Botany Bay, in an ESE. gale with heavy squalls, showers of rain and rough easterly sea. The land was in sight at an estimated distance of about eight miles, actually, it is probable, not more than six, for in such weather an error of a few miles might easily be made. She stood on, heading about NNE. close-hauled on the starboard tack, under fore-sail and close-reefed fore and main topsails. The revolving light on the south head of Port Jackson was frequently seen between the showers; but the night was very dark, the land was no longer visible, weather conditions grew worse and the ship made several points of leeway, so that her true course would be about NNW. and her speed only three miles per hour.

Shortly after 11.30 p.m., when South Head light was a point or two abaft the beam, the *Dunbar* was probably reckoned to be about six miles outside the entrance to the port (actually she was within two miles). All hands were called on deck and the ship was kept away to the westward for the entrance, running before the wind with her yards almost square and the South Head light slightly on her port bow. The foresail was hauled up and a very sharp look-out kept for North Head, which was not seen; a few minutes later, however, breakers were seen right ahead. At once the master knew he was close in to Outer South Head, ordered the helm to be put hard a-port and the yards braced sharp up on the starboard tack, in hopes of clawing off the land again to the north-eastward, and his orders were promptly carried out. But, with wind and sea setting her strongly to leeward, the ship was too close in and carried too little sail, and, though she started to turn to the northwards, about two minutes later (shortly after midnight) her port bow struck the rocks and she was hurled almost broadside on to the cliffs just north of the signal station, midway between the lighthouse and the Gap.

With the first shock the topmasts went overboard. Directly afterwards the sea broke over her starboard side, carrying away people, boats, bulwarks, and masts, and in a very short time she had crashed to pieces. There was only one survivor, a young able seaman named James Johnson, who had been on deck since 8 p.m.; and it is from his clear and intelligent evidence, given at the inquest held four days later, that the above account has been obtained.

Next day floating wreckage showed that a vessel had been wrecked. Her position was soon found, and many bodies were seen being dashed about by heavy seas, the sprays from which drenched men on top of the cliffs. On the following day Johnson was seen and rescued, having spent some 36 hours on a ledge of the cliffs; and during the succeeding days wreckage of all description, with numbers of mutilated bodies, was found scattered along the beaches of Middle and North harbours. At the inquest, held on 24 August, the jury's verdict was that 'there may have been an error in judgment in the vessel being so close to the shore at night in such bad weather, but they do not attach any blame to Captain Green or his officers for the loss of the *Dunbar.*'

In 1910 a number of relics—anchors, cable, chainplates, copper bolts, coins, etc.—were obtained from the wreck, and are now preserved in the adjacent suburb of Watson's Bay.

In the popular idea that the *Dunbar* was lost because her captain had somehow mistaken the small indentation called the Gap for the mile-wide entrance to Port Jackson there is neither a vestige of truth nor the remotest probability. Green may have attempted to run into the port on such a night because he knew, from the leeway the ship was making, that she could not possibly weather the land but must inevitably be blown ashore and wrecked within a few hours; hence his only chance for

safety was to run into port and anchor. Had he continued only one mile farther to the northward before rounding for the entrance, he would have taken his ship safely in, and this slight error in reckoning was most probably due to the current setting to SSW. F.J.B.

Dunlop, JAMES (1793-1848), born at Dalry in Ayrshire, Scotland, on 31 October 1793, at the age of 14 was employed in a thread factory at Beith, and while there attended a night school where he made a lasting friendship with John Dunmore Lang (q.v.). About 1810 he began experimenting with lathes, telescopes, and reflector-casting; and in 1820, on his return to Beith from Dalry (where he spent two years as a handloom weaver), he met Sir Thomas Brisbane (q.v.), who had a private observatory in the neighbourhood. When Brisbane was appointed to the governorship of New South Wales he selected Carl Rümker (q.v.) and James Dunlop to accompany him as assistants for the observatory he proposed to establish in the colony. The party arrived in Sydney on 7 November 1821; an observatory was at once erected at Parramatta, and the two assistants worked together until 1823, when Rümker left the observatory. Dunlop then carried on the work alone until March 1826, when, Brisbane having left the colony, the observatory was abandoned. An account of the work done in it is given under ASTRONOMY. Dunlop continued his astronomical survey at his home in Parramatta until 4 February 1827, when he returned to Scotland to Brisbane's new observatory at Makerstoun on the River Tweed. He accompanied Brisbane on several continental tours in connection with astronomy, and from 1827-9 contributed papers to the *Edinburgh Journal of Science*. On 6 February 1828 he was awarded the gold medal of the Royal Astronomical Society of London, and subsequently received various European honours. Having in 1830 been appointed by the colonial office to be superintendent of the government observatory at Parramatta, he returned to the colony on 6 November 1831, and until 1839 made regular observations, most of his work being recorded in eight manuscript books preserved at the Sydney observatory. In September 1833 he discovered a comet, and was awarded a gold medal therefor by the King of Denmark, but the British astronomer-royal of the time (Francis Baily) apparently forgot to send the medal out; it was found in 1845 among Baily's effects after his death, and Dunlop received it in November of that year. From Sydney he sent many papers to the Royal Astronomical Society of London, and in 1835 became a corresponding member of the Institut de France. After 1839 he suffered frequently from ill-health, and in November 1847 resigned his position and retired to his farm at Boora Boora on Brisbane Water; there he died on 22 September 1848.

See his biography in Service's *Thir Notandums, being the Literary Recreations of Laird Canticarl of Mongrynen*, published in 1890.

Dunne, ROBERT (1830-1917), born at Lismore in Ireland, and educated at the Irish College in Rome, was professor for a short time at St. Laurence's school, Dublin, and in 1863 came to Brisbane; there he worked as a missionary priest under Bishop O'Quinn, becoming successively secretary and administrator of the cathedral, pastor of Toowoomba, and vicar-general of the diocese. On 18 June 1882 he succeeded Dr. O'Quinn as bishop of Brisbane. He acted as secretary to the plenary council of Australasia held at Sydney in 1885. At the petition of this council Queensland was erected into an independent ecclesiastical province, with Brisbane as the archiepiscopal see, and on 10 May 1887 Dr. Dunne was constituted its first archbishop. During his episcopate schools, convents, and churches were erected with great rapidity; after ten years' administration he had erected or completed 41 churches. On 26 February 1912 the aged archbishop was given the assistance of a coadjutor, Dr. Duhig. He died at Brisbane on 13 January 1917, and was succeeded by his coadjutor. E.M.O'B.

Dutton, FRANCIS STACKER (1816-1877), born at Cuxhaven in Germany in 1816, and educated in Switzerland, adopted at first a mercantile life and spent five years (1833-8) in the employ of a firm in Rio de Janeiro, Brazil. In 1839 he migrated to New South Wales to join two brothers who had taken up land beyond Bowning on the Murrumbidgee and Tumut rivers. Bush life, however, did not for the moment appeal to him, and he crossed to Melbourne and resumed commercial work there for two years. In 1841 he went to South Australia, where his brother Frederick (who had left New South Wales for South Australia in 1839) procured him a post as overseer on Charles Bagot's Kapunda run. Here in 1843 he discovered a copper lode, and he and Bagot were at first joint owners of the Kapunda mine; but in 1845 Dutton sold his interest in it to an East Indies firm, and went back to pastoral life. In 1851-7 he was a member of the South Australian legislative council, and with John Baker and G. S. Kingston (q.v.) led the opposition to the governor's general policy, especially in connection with the new constitution; his special contribution to the constitutional debates was a strong advocacy of vote by ballot. In the legislative assembly of 1857 he was one of the six members for Adelaide city, and held the seat until 1865. In September 1857 he joined the Hanson ministry as commissioner of crown lands, but resigned in 1859; he held the same office in his own short-lived ministry of 1863, but in his second ministry (1865) was commissioner of public works (this was that remarkable period of South Australian history when there were six ministries in 27 months, Henry Ayers being a member of all of them and John Hart and Richard Andrews of four). In September 1865 Dutton left politics to take the agent-generalship for his colony in London, and held the position till his death on 25 January 1877. He was the author of a useful book on the early days of the colony, *South Australia and its Mines*, published in London in 1846. (C.M.G., 1872.)

Dutton, WILLIAM (1809?-1878)—by some authorities confused with William Hampden Dutton, brother of the Francis Dutton just dealt with—was born in Sydney, probably in 1809, taken while still an infant to Tasmania by his parents, and at the age of 18 entered aboard a whaler. In 1828-33 he was serving in various vessels engaged in sealing at Portland Bay, and according to his own account built a house there in 1829 and lived in it for nearly two years in all; on this ground he in 1873 claimed to be the first permanent settler on Victorian soil, antedating the Hentys (q.v.) by five years. In 1833, returning to Portland Bay as master of the whaler *Henry*, he enlarged his establishment to include a vegetable garden, and

his claim to priority as against the Hentys (who first settled there in November 1834) really depends on the question whether this amount of cultivation can be considered a *bona fide* settlement. From 1834 onwards Dutton's connection with the Bay was tenuous; he was commanding vessels owned by a Tasmanian firm in which James Henty was a partner, and was sent to other fisheries, paying only five visits to Portland Bay between 1833 and 1845. By 1851, however, he had abandoned the sea and settled at Narrawong near the head of the Bay, and there he died in July 1878.

Dysoxylon, a large genus of the family Meliaceae, consisting of trees, spread over tropical Asia and Malaysia and extending to New Zealand. Thirteen species are indigenous to Australia. *D. Muelleri* (Red-bean), is a large tree, with a bark emitting a strong odour like that of a swede turnip; the timber is fit for the same purposes as Spanish mahogany. *D. Fraserianum* (Rosewood, so called because of the sweet and persistent perfume of the timber) is a large tree, 70-100 feet high and 4-5 feet in diameter. Its timber is used for indoor work of all descriptions in the building trade, especially for flooring ball-rooms, for which purpose it is said to equal tallow-wood. *D. rufum* (Bastard Pencil Cedar) is a large tree, whose flowers and fruits have an onion-like, almost fetid smell. The timber is soft and fissile, belonging to the cedar class. All three are coastal brush trees, extending from the northern rivers of New South Wales into Queensland.

E

Eagar, GEOFFREY (1818-1891), born in Sydney in 1818 and educated at W. T. Cape's school, was up to his fortieth year engaged in commerce and banking, diversified by writing for the *Monitor* and the *Empire*. On 13 September 1859 he was nominated to the legislative council, and was secretary for public works in the brief Forster ministry of 1859-60. He left the council in November 1860, but on 8 January 1863 was returned to the legislative assembly by West Sydney, and in October joined the first Martin ministry (1863-5) as colonial treasurer, resuming the same post in the second (1866-8). During his third ministry (1870-2) Martin made Eagar—whose financial knowledge had been of great use to him—under-secretary of finance and trade; this position he held until February 1891, when he retired, dying on 12 September of that year. During his second treasurership he advocated the establishment of a national bank with a State note circulation, and aided his leader Martin to negotiate with the Victorian government an amicable arrangement of border tariffs.

Eagle-rays, members of the family Myliobatidae, having sharp, angular, wing-like expansions of the body-disk, which, together with their somewhat bird-like heads, are responsible for their vernacular name. They resemble sting-rays in having barbed spines on the tail, but are characterized by their remarkable teeth, which form tessellated structures well adapted for crushing the shell-fish, etc. upon which they feed. A common southern species, *Myliobatis australis*, is yellowish in colour with large blue spots; it is often secured by trawlers, and its 'wings,' together with those of sting-rays, are sold in the markets as 'skate.' Another species, *Aetobatis narinari*, a denizen of tropical waters, is remarkable for its long whip-like tail, which may be four times as long as the body. It is dark in colour, with large white spots, and attains a width of six feet. A.R.McC.

Eagles. See HAWKS.

Eardley-Wilmot, SIR JOHN EARDLEY (1783-1847), born in London on 21 February 1783 and educated at Harrow, was called to the bar at Lincoln's Inn in 1806 and for a time practised on the Midland circuit. In 1808 he settled down on his Warwickshire estate, farming and performing the usual magisterial functions of an English landowner. In 1821 he was made a baronet in recognition of the services of his grandfather, who had been chief justice of the common pleas from 1766 to 1771. In 1822 he published an abridgement of Blackstone's Commentaries, and from 1832 to 1843 represented northern Warwickshire in parliament. During these years he wrote a good deal on prison discipline, and in 1843 Lord Stanley, then colonial secretary under Sir Robert Peel, offered him the governorship of Tasmania, where it was proposed to institute a new system of penal reform for which see CONVICTS. On 21 August 1843 Eardley-Wilmot took office as lieutenant-governor of Tasmania, the first civilian to occupy that position; in 1844 his authority was extended to include the administration of Norfolk Island.

He was confronted from the outset by very great difficulties. Thousands of convicts were being poured into the colony during a period of financial depression, when industry was at a standstill. By the beginning of 1847 the population numbered 66,000, of whom 29,000 were convicts. The labour of convicts employed on public works was valued by the British government at 6d. per head per day, the amount being charged against the colonial revenue, which also had to meet a large part of the cost of maintenance and gaols. The free settlers, already suffering from the economic depression, insisted that the only solution of the problem was a reduction in the number of convicts transported, and an increase in the British grant to meet indirect expenses of the penal system; but no financial relief was granted, and the country became involved in an accumulating debt. Eardley-Wilmot, after suggesting several expedients which were ignored or rejected either by the colonial office or the settlers, summoned the legislative council on 21 October 1845 to consider an appropriation bill which provided *inter alia* for an increase in *ad valorem* duties from 5 to 15 per cent. The bill was strenuously opposed by the six unofficial nominees; when the governor showed his determination to force it through, they left the council in a body, thus reducing the number of members present below a legal quorum. In explaining the reasons for their subsequent resignation they declared that they had been asked to 'vote an expenditure the colony could not bear and anticipate a revenue higher than the customs department calculated on receiving.'

This action of the 'patriotic six' was stigmatized as disloyal by Eardley-Wilmot, who maintained that they had exceeded their constitutional rights as nominees and assumed those properly belonging to elected representatives of the people—a distinction which was not supported by the colonial office. The deadlock continued until Britain agreed to contribute £24,000 per annum towards the maintenance of police and gaols; meanwhile Eardley-Wilmot was recalled, and Charles Latrobe (q.v.) appointed on 13 October 1846 to take over the administration of the colony. The recall was alleged by the colonial office to be due not to any political or economic action taken by him—though his accusations of disloyalty against the 'patriotic six' were considered extreme—but to his failure to give due attention to 'the pressing

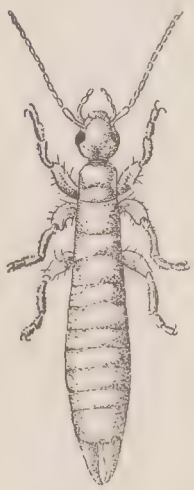
exigencies of convict discipline.' His chief task should have been to impress a 'moral and reformatory character' upon the convict system, and in this the office considered that he had failed. In a private letter Eardley-Wilmot was further informed that he would not be offered another official position, on account of rumours derogatory to his private character which had reached the colonial office. These vague accusations were indignantly repelled not only by Eardley-Wilmot himself but by the chief justice and other leading citizens of the colony, but it is probable that they were never seriously urged. It was the advent of the Whig ministry under Russell, committed to new theories of colonization and bitterly opposed to Stanley (whom they regarded as a renegade Whig), that ensured Eardley-Wilmot's dismissal on almost any excuse. Hoping, however, that justice would be done him when refutation of the attacks on his private character reached England, he remained in Tasmania, and died there on 3 February 1847.

Earthworms, members of the sub-class Oligochaeta of the division Chaetopoda (bristle-worms, q.v.), in which the bristles are comparatively few. The typical European genus is *Lumbricus*, a form which, with its nearest allies, seems to thrive wherever it is introduced and to oust the native genera. The most ancient genera, however, seem to have originated in some now sunken area in the South Pacific, and the most primitive form now extant is the New Zealand *Notiodrilus*. W. B. Benham (*Report* of the Australasian Association for the Advancement of Science, ix. 319-343) founds on the distribution of earthworms in the southern hemisphere a strong argument for the former existence of a great southern continent.

Among species endemic in Australia those belonging to the characteristic family Cryptodrilidae deserve special notice. One of them, *Megascolides australis*, found in Gippsland, attains a length of six feet with a diameter of about three-quarters of an inch. This extraordinary worm lives in burrows near the surface of the ground, and travels in them very rapidly when disturbed. Unlike perichaetous worms, which move by means of their setae, the Gippsland worm has a method entirely its own. It expands its hinder end (i.e. whichever end is hindmost at the moment) so as to wedge it tightly in the burrow, then stretches to full length, anchors its forward end by a similar expansion, loosens the hinder end, and contracts the rest of the body; the hinder end is now wedged in its new position, the body stretched again, and so on. These movements are accompanied by a distinctly audible sound—a sort of gurgle—due to the fact that the worm is slipping through a fluid secretion with which the burrow is partially filled.

Other large and notable species are *M. grandis* and *Didymogaster sylvaticus* of New South Wales. Otherwise the Australian earthworms (so far as they have yet been examined, for the western genera have not been dealt with systematically) do not greatly differ from those of other regions. It is, however, notable that they have considerable affinity with the forms found in Ceylon, and very little with those of New Zealand. T.S.

Earwigs, insects of the family Forficulidae, belonging to the sub-order Dermaptera of the order Orthoptera. They may be recognized at once by their long, slender shape, their forceps-like terminal cerci, and the high specialization of their wings. The tegmina are reduced to flaps, serving to cover the exceedingly beautiful hind-wings, which consist of an elaborately constructed fan formed from the anal area, and capable of being folded up (both lengthwise and crosswise) in a complicated manner. Only about 30 Australian species have been described, so that they do not form a very noticeable part of our fauna. Perhaps the most striking forms are the wingless species of the genus *Anisolabis* and its allies, of which the large *Titanolabis colossea* reaches a length of 2½ inches. Only the introduced species (*Forficula auricularia*) has become a pest—especially in Tasmania, where it is omnivorous; it devours plants (delighting especially in seedlings and the buds of carnations, dahlias, and chrysanthemums) the paste in the bindings of books, bread, jam, and even other insects, including the earlier stages of the codlin moth. It is also a fruit and vegetable pest, making holes in ripening apples, pears, peaches, and other stone-fruit, and destroying young potato-plants and beans. The forceps of the earwig, though capable of inflicting a painful nip, are not poisonous. One of their uses is to fold the wings after flight. The creamy-white eggs are elliptic, and are laid in clusters of a dozen or more, the mother watching over them and the young, when hatched, like a hen over her chickens. See ORTHOPTERA. R.J.T.



Titanolabis colossea.

Ebden, CHARLES HOTSON (1811-1867), son of J. B. Ebden, a politician of the Cape Colony, was born in London in 1811, and about 1832 migrated via Tasmania to New South Wales, where he commenced pastoralist. In 1835 he took up Bonegilla, the first run formed south of the Murray, and in 1837 sent overland to the Goulburn River the first mob of sheep that ever crossed the Murray; he was also active in procuring the opening of the road from the Murray to Melbourne, and bought land at the first Melbourne land-sale. When the Port Phillip district obtained representation on the New South Wales legislature in 1843, Ebden headed the poll, but resigned next year on the ground that the representation was a sham, and that a new colony should be created; in 1847 he refused re-election but returned to the New South Wales council in 1850 and took an active part in the arrangements preparatory to the separation of Victoria. After separation he became auditor-general of the new colony, but resigned after a year's service, visited England, and on his return in 1856 was elected to the legislative council. He was treasurer in the Haines-McCulloch ministry of 1857-8, and became chairman of the St. Kilda and Brighton railway; but in 1860 he returned to England, and lived there for six years, dying at Melbourne while on a visit to Australia on 28 October 1867.

Ebenaceae, a small tropical or subtropical family of trees or shrubs; 2 genera and 15 species are indigenous to Australia. The leaves are entire; flowers unisexual, the sexes on distinct plants; fruit a berry. *Cargillea* is a genus of 3 species endemic in the eastern States; *C. australis* (Black Plum, the 'boor-eera' of the aborigines) is a small tree with dark purple fruits as large as a plum, eaten by the natives. Its wood is tough, and makes excellent whip-handles. The timber of *C. pentamera* is used for flooring-boards. Of the tropical genus *Maba* 9 species are indigenous to Australia. *M. laurina* has a green, palm-like, edible fruit; *M. fasciculosa* has a strong, elastic wood, of a light colour with black streaks, suitable for carving. The timber of *M. geminata* is hard and heavy, bright near the bark, and black towards the centre; this portion is regarded as a good substitute for ebony.

Echidna, vernacular name of *Tachyglossus aculeatus,* also called 'native hedgehog,' 'native porcupine,' and 'spiny anteater,' one of the three known representatives of the sub-class Monotremata, the most primitive mammals on earth. The physical characteristics which it shares with the platypus are discussed under MONOTREMATA. The head and trunk of the echidna are together about 18 inches long, but the tail is a mere vestige. The back and sides are covered with strong pointed spines, yellowish in colour, with black tips; these are greatly developed hairs, and between them there is a covering of coarse black or brown hairs, like those which form the sole covering of the lower surface. The narrow black snout is almost cylindrical, and the mouth very small. The short and powerful limbs are specially modified to act as digging organs, and the five toes of each, which are not united by a web, are armed with very strong claws. The male, like the male platypus, has a spur—represented in the female by a mere rudiment— on the inner side of the hind foot.

The echidna does not construct elaborate burrows like those of the platypus. During the day it usually hides in crevices about the roots of trees, or among rocks, or in shallow holes which it digs for itself. At night it sallies forth in search of its food—insects of various kinds, grubs, and worms, but mainly ants and termites. These, which form the bulk of its food, it captures by means of its long, narrow and protrusible tongue, which is coated with a viscid saliva. Very rarely is the echidna encountered, even by day. When disturbed, it quickly burrows directly downwards, sinking with remarkable rapidity below the surface, even in hard soil.

In the breeding-season (winter or early spring) the female usually produces a single egg, which is deposited in a temporary pouch, formed for its reception on the lower surface of the mother's body, in an area which encloses the openings of the ducts of the milk-glands. There the young animal, escaped from the shell, and nourished by the secretion of the milk-glands—which it licks from the concave surface on which the ducts open—grows to a considerable size (about six inches in length) before it permanently leaves the pouch. When it reaches a certain size, it is no longer carried about by the mother on her nightly excursions for food.

Three varieties of *T. aculeatus* have been described. The name 'var. *typicus*' has been proposed to distinguish the common form occurring in continental Australia; var. *lawesii,* which inhabits south-eastern New Guinea, is rather smaller and has shorter spines. *T. aculeatus* var. *setosus,* the Tasmanian form, is the largest (about 20 inches in length) and has hair longer than the others. A Papuan genus *Proechidna* (with two species), is distinguished by the exceptional length of its narrow snout or beak; this is about twice as long as the rest of the head, and is bent downwards. It has usually only three claws on each foot, though specimens have been found with four and five. W.A.H.

Semon's *In the Australian Bush* (p. 162) expresses the belief that the mother echidna places her egg in the pouch by means of her long muzzle, and Wood Jones, in *Mammals of South Australia,* accepts this view. From personal observation the hypothesis appears unnecessary and probably incorrect. In three cases the present writer has found fresh excreta in the fully developed pouches of adult females; this suggests that the egg may be similarly deposited directly in the pouch, without the assistance of either limbs or snout. After transmission the pouched egg is carried about by the mother until the fetus uses its projecting snout to burst through the soft, capsule-like eggshell. Although development of the embryo is comparatively rapid, it is questionable whether it requires mother's milk for some considerable period after hatching; its relative the young platypus (q.v.) does not. But a pouched echidna, measuring 2¾ inches from tip of snout to tip of tail, convinced me by the occasional protrusion and wriggling of its long narrow tongue, combined with the continuous motion of its well-developed fore-paws, that it had become expert in the art of inducing milk to flow from the mother's teatless glands.

The young echidna is sometimes carried in the pouch until the tiny quills become troublesome to the mother; at that stage the youngster is planted in a small burrow, excavated by the parent, until it can fend for itself. Some naturalists surmise (usually on the evidence of aborigines) that the mother occasionally visits her imprisoned offspring to supply it with food. But theories based on aboriginal information can hardly be accepted as final. C. H. H. Jerrard, of Blackdown near Gayndah in Queensland, rescued a young echidna nine inches long, that had just been unearthed from a burrow by a goanna; the podgy, flabby youngster was naked, save for a sparse crop of stubbly black hairs and (here and there) rudimentary quills measuring ⅛ inch in length. At first, attempts to feed it met with very limited success, but by holding its snout forcibly in a saucer of milk it could be sometimes induced to protrude its long, slender tongue and lap a little; one such meal sufficed it for several days. After a month it would crawl a few inches to the saucer of bread and milk that always stood in its box, and help itself. It lost weight, and the only growth observable was in the length and number of its spine-points. After 10 weeks it began to nuzzle round in search of food. This and other observations suggest that the young echidna's term in its lonely burrow is a kind of hibernation, and that there is no necessity whatever for the mother to return to her offspring after depositing it therein.

H.B.

Echinodermata, invertebrate animals of which starfish, brittle-stars, sea-urchins, sea-

lilies and bêche-de-mer or trepang are familiar examples. The name, meaning 'spiny-skinned,' does not literally suit all the forms; but all have an underlying skeleton of calcareous plates (ossicles) which in most cases push the skin outwards, thus giving it a spiny appearance. Echinoderms, except one sea-cucumber which occurs in brackish water in the tropics, are marine animals. Starfish and sea-urchins are common objects in rock pools; the corona of the sea-urchin, left as such by the loss of the spines after death, is often found on beaches, and is popularly known as a sea-egg. Brittle-stars and sea-lilies live below low-water mark, and bêche-de-mer is found among the coral reefs of northern Australia. The echinoderm organization is characterized by a radial symmetry, in which the vital organs of the body are repeated, and are arranged like the spokes of a wheel round a central axis. The water vascular system is in the form of a ring surrounding the mouth. From it a number of canals (usually eight) radiate to different parts of the body; each canal bears a double series of lateral branches which push the skin out in little projections known as tube-feet; and these, besides assisting in locomotion, have a respiratory and sensory function. A stone canal is also given off from the ring; this is vertical, and communicates with the exterior by a sieve-like plate (madreporite), which is more or less conspicuous in the starfish and sea-egg. All these canals are lined with cilia, which by constant vibration produce a strong inward current that keeps the water vascular system tensely filled with water.

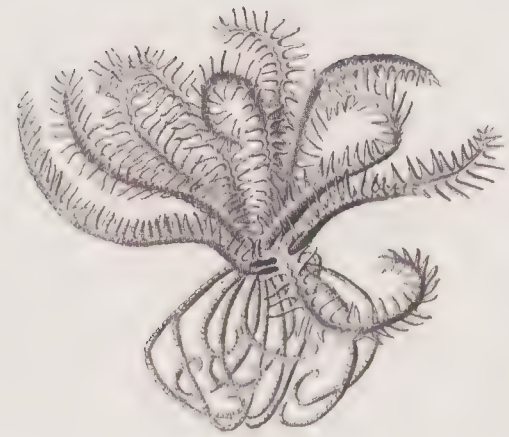
Echinoderms fall naturally into two sub-phyla, one (Eleutherozoa) comprising the freely moving members, such as the starfish and sea-urchin, the second (Pelmatozoa) including the sea-lilies and allied forms capable of becoming fixed or anchored. Of Eleutherozoa there are four classes, Asteroidea (starfish), Ophiuroidea (brittle-stars), Echinoidea (sea-urchins, heart- and cake-urchins) and Holothuroidea (sea-cucumbers, bêche-de-mer). The known echinoderm fauna of Australia includes about 670 valid species, of which 320 belong to the Holothuroidea. Two hundred species are endemic, and 65 are found only on the eastern coast.

The body of a starfish is represented by five or more arms radiating from a central disk; the living animal is usually conspicuous through its varied and beautiful colouring. The upper surface is rough or prickly; in the centre is the small anal opening, and close to it the madreporite. The spines continue down the arms, and among them a lens will reveal the pedicellariae—little stalked pincers that assist in locomotion and adhesion. The lower surface has in its centre the mouth, from which a groove runs along the centre of each arm; this is known as the ambulacral groove, and along its edges the tube-feet are constantly moving and feeling for some object to which the sucker-like tips may cling. The tube-feet allow the starfish to move in a leisurely manner, and, aided by the pedicellariae, to right itself when thrown off its balance. Having no head, the animal moves in any desired direction by the movement of the tube-feet in parallel planes; its sense of direction is probably guided by the primitive eye placed at the tip of each arm.

Like some other members of the phylum, the starfish possesses the curious powers of self-mutilation and of regenerating lost parts. It will promptly discard an arm if attacked, and eventually grow another; this accounts for the finding of starfish with one or more arms in disproportion to the others. Its food consists almost entirely of bivalved molluscs, whose shell is gripped by the closing of the arms, and the valves forced apart with the assistance of the tube-feet; the stomach is everted through the mouth, closing over the mollusc and retaining it until the food is assimilated. *Asterina calcar*, a common starfish in and near Port Jackson, has a cake-shaped body and eight short, blunt arms; the disk is mottled with various shades of black, chocolate, orange, green and purple. *A. exigua* with five rays, and *A. gunnii* with six, are equally common. Contrasted with these we have *Coscinasterias calamaria*, brightly coloured in patches of sepia and sage-green with a margin of vivid red; its long, finger-shaped arms are usually irregular in shape and size.

Brittle-stars are so called because of their habit of throwing off their arms when molested. The disk of a brittle-star is more or less circular, and the arms are not a continuation of it, but are inserted into grooves on the underside, coalescing with the frame-work that surrounds the mouth. The ambulacral grooves are represented by closed canals, and the functions of the tube-feet are purely respiratory and sensory. The arms are made up of a series of disk-like ossicles or vertebrae, each vertebra connecting with its neighbours by cup-and-ball joints. The vertebrae are also connected by powerful longitudinal muscles which enable the arms to wriggle and lash if active motion is required, or by curling to hold strongly on to weed or rocks. Brittle-stars are commonly found on the coast, tangled among weed or under stones; like starfish, they are often quaintly and conspicuously coloured. *Ophiothrix fumaria*, a pretty brittle-star found in Port Jackson and along the coast, has conspicuously banded arms. It lives under stones in the shallow water; if the stone is lifted, the timid creature promptly throws off all its arms even before it is actually molested.

Sea-urchins seem at first sight to be widely separated from the two preceding classes, but the plan on which they are constructed agrees in essence with that of the starfish and the brittle-star. The corona of the sea-urchin consists of ten bands of plates, each differing from its nearest neighbours, so that five bands of ambulacral and five bands of interambulacral plates are formed. A circle of plates on the upper surface shows further differences in formation. Each row of plates is studded with bosses and tiny elevations; the larger and smaller bosses are for the attachment of the primary and secondary spines respectively, the little elevations (miliary tubercles) are for the pedicellariae. The ambulacral bands have rows of pores round their edges, through which the tube-feet protrude. The ring of plates round the upper surface consists of five larger (genital) plates and five smaller (ocular) plates, each of the latter bearing in life a rudimentary eye; a madreporite is amalgamated with one of the genital plates. The under-surface of the corona has a large opening, through which mouth and jaws may protrude. The mouth is surrounded by an external membrane, and five chisel-edged teeth together form a structure known as 'Aristotle's lantern;' this lantern is often found in the sea-egg. The whole body is covered with skin, bearing numerous pedicellariae; these, owing to the presence of the long spines, cannot subserve locomotion or adhesion,



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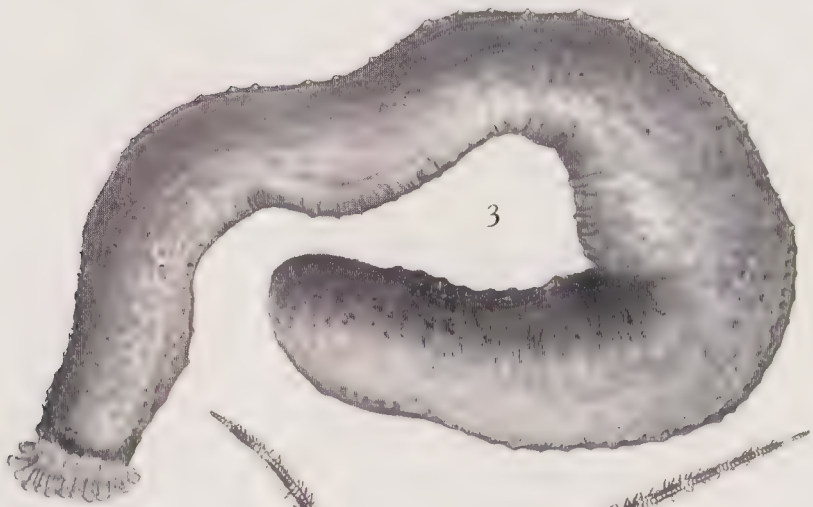

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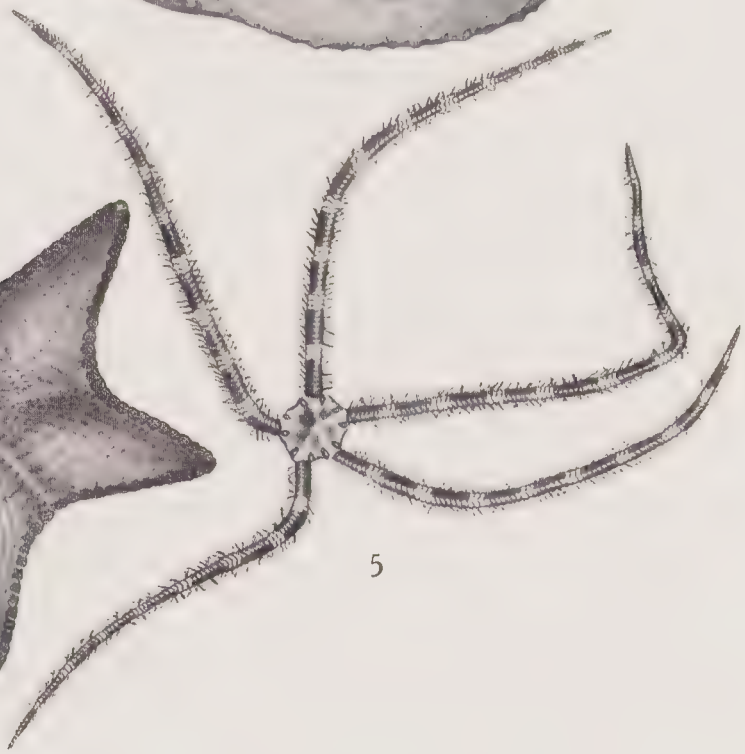

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1. Feather-star, *Amphimetra discoidea*
2. Sea-urchin, *Toxocidaris erythrogrammus*
3. Bêche-de-mer, *Holothuria colubra*
4. Starfish, *Anthenea acuta*
5. Brittle-star, *Pectinura marmorata*

and are probably used to clean the skin. Echinoids are of various shapes and sizes, as the names 'cake' and 'heart' urchin would imply. The spines of a large sea-urchin (*Heterocentrotus mammillatus*) are used as slate-pencils by children at Cooktown in Queensland. *Toxocidaris erythrogrammus*, a dark purple urchin with dense, short, fluted spines, is very common along the coast-line. It excavates for itself a deep cup-like depression in the sandstone, and leaves this retreat in search of food when the tide suits, but returns as soon as the tide changes. It is apparently nervous and, while in its cup, further protects itself from observation by holding pieces of shell and stone over its body by means of the pedicellariae; these pieces must have been gathered by the elongated tube-feet that protrude from the dorsal surface. *Amblypneustes ovum*, a pretty urchin inhabiting Port Jackson, makes its home in dwarf kelp, and uses its tube-feet to draw a leafy curtain round itself.

The species of *Holothuria* (sea-cucumbers, trepang, bêche-de-mer) have no arms or spines. The skeleton consists of little nodules of calcium carbonate embedded in the skin. A system of longitudinal muscles enables the animal to move with slow, worm-like contractions of the body; while moving, it sweeps its tentacles (which are in a mop-like tuft) over the sand and thrusts them into its mouth with the sand they have caught up. The food matter consists of foraminifera, which are swallowed along with a big percentage of sand and fragments of coral. Bêche-de-mer is of economic importance. On the Great Barrier Reef (q.v.) the creatures are collected into sacks, taken to the curing stations, and boiled in cauldrons for 20 minutes; they are then taken out, slit open and gutted, and exposed to the sun until the greater part of the moisture has evaporated, and smoked in a 'smoke-house.' Smoking takes about 24 hours, the wood most in favour being that of the red mangrove; it greatly reduces the size, so that the finished article looks very much like a charred sausage. Luggers of five to six tons burthen are used for fishing, and often carry their own smoke-house. Aborigines and Malays are largely employed in the work. The average annual value of bêche-de-mer obtained in Australia for 1919-22 was £57,875.

Sea-lilies and feather-stars belong to the Pelmatozoa. Of the five classes into which this sub-phylum is divided only one—the Crinoidea—includes living forms, and these are few in number compared to the fossil forms contained in the other four. There are 66 known species in Australian waters, excluding those that live at depths of over 300 fathoms. From the main part of the body (calyx) long delicate arms radiate, each bearing a series of shorter branches (pinnules). The calyx is in most cases built up of several whorls of plates; the anatomy in the main corresponds with that of the Eleutherozoa. Pelmatozoa are fixed or anchored (at least in the younger stages) by the centre of the ab-oral surface; this is produced into a stem covered with small outgrowths (cirri) by means of which the animal anchors itself. Many forms have become free, and swim with graceful movements by muscular contractions of the arms. Sea-lilies grow in fields in deep water; the decks of cable-repairing ships are often strewn with them after a cable has been lifted from the ocean bed.

R.W.B.

Education, Public. Throughout Australia education is made a matter of the first public concern. Primary (elementary) education is everywhere compulsory and, partly as a consequence, partly from enlightened policy, is everywhere free to those who receive their teaching in the state schools. Meanwhile, subject to precautions which will be stated later, both private tuition and attendance at non-state schools are accepted as substitutes. Each State regulates its own system, makes its own appointments, and provides for the necessary expenditure. That this is fairly liberal may be judged from the fact that in New South Wales, the State with the largest population, the expenditure upon all forms of educational and scientific activity for 1922-3 amounted to £3,777,551. Though the several systems are thus independent, they are nevertheless brought into a general harmony by reciprocal comparisons and consultations as to both aims and standards, and—as will be seen—differ only in details, which are mainly determined by differences in the resources or other special conditions of the respective States. In the Federal Capital Territory it has for the present been found geographically convenient to place primary education under the system and conduct of New South Wales, the Commonwealth bearing the expense; in the Northern Territory the Commonwealth itself administers; but in both areas the children of school age are still but few. The results of this attention to educational progress are apparent from statistics. The illiterates among Australian-born people between 60 and 64 years old number almost 4 per cent; for those between 40 and 44 the figures are under 1¼ per cent, and for those between 10 and 15 just 6 per thousand. In metropolitan areas the number between 10 and 15 is only 4 per thousand, and outside them illiteracy among the young increases with the sparseness of the population.

This article deals only with primary and secondary schools under government control. For university education see UNIVERSITIES; for the history of private education see SCHOOLS.

Primary Education.—The early history of primary education is necessarily that of its development in *New South Wales*, which once included all the eastern colonies of Australia. There education for several decades followed the usual course, beginning with voluntary enterprise supported in some measure by various religious denominations, gradually gaining more and more recognition and financial aid from the government, and ultimately passing either entirely into its hands or under its more or less strict supervision. Naturally, a struggle of vital importance was long maintained over the questions whether religious instruction should be included in the curriculum, and whether, if particular denominations established their own schools, they should receive supporting grants from the State. Nor are those questions yet dead, although under the existing systems they might appear to have been definitely answered.

No schoolmaster arrived with the 'first fleet' in 1788, and the first modest endowment of education began in 1794 with a grant to Richard Johnson and William Richardson of £10 per annum from the Society for the Propagation of the Gospel. That payment was continued by the society to a number of schoolmasters until 1830, though meanwhile more substantial and systematized aid had become available. Thus in 1802, before any 'school rate' was thought of

in England, settlers about the Green Hills (i.e., in the Windsor district) had agreed to pay 2d. per acre for 14 years to maintain a school in their district. In 1807 Samuel Marsden (q.v.) being in England, aroused the colonial office to the need of education in New South Wales, and under Governor Macquarie schools were established in the principal centres. After 1810 they were generally established by grants from the administration, derived from certain customs duties earmarked as 'orphan dues' (so named from their original application to the upbringing of orphans). During all the early period religious instruction, including the Anglican catechism, was given everywhere without regard to the denomination of the pupils, but in 1836 Governor Bourke advised that the 'Irish National System' should be introduced into the colony. This arrangement, though approved by the authorities in London, was strenuously opposed in the colony, and nothing was done until 1841, when regulations issued on 24 September made provision for government grants-in-aid to all schools—irrespective of denomination—on a scale determined by the number of children of poor parents enrolled. It would appear that in many schools a practice had grown up, and had become notorious in 1840-1, of charging to government account half the cost of educating children whose parents could well afford to pay their fees. In 1844 Robert Lowe (afterwards Lord Sherbrooke, q.v.) carried in the legislative council of New South Wales a motion for a select committee to report upon education as suited to the needs and wishes of the majority of the community. The report (which revealed the fact that half the children between 4 and 14 years of age were receiving no education at all) favoured a general system in preference to a denominational, and recommended that adherence to such a system should be a condition for receiving government aid. The scheme would institute a board invested with wide discretion, its leading principle being that the same facilities should be afforded to all Christians without attempt to interfere with any denomination or to proselytize. Supporters of denominational education were, however, strong enough to maintain the *status quo* until 1848, when an awkward system of dual control came into being. A board of national education was established side by side with a board of denominational education—the latter being composed of the representatives of the Anglican, Roman Catholic, Presbyterian, and Wesleyan Churches, appointed to distribute the sums voted for the denominational schools. By 1850 there were 43 national schools, and 52 others in process of formation; the denominational schools numbered 185. The result was a vexatious rivalry between the two boards, until in 1867 Parkes's public schools act placed the public expenditure for primary education under a council of education; this was given the fullest powers, including provision for granting aid, under certain restrictions, to denominational schools. In all schools instruction was to be both secular and religious, but the term 'secular,' even in the state schools, included general (i.e. undogmatic and unpolemical) religious teaching. The feeling against the grant of financial support to denominational schools grew to such an extent that in 1880 this aid was withdrawn by the public instruction act (also fathered by Henry Parkes), which placed education under a responsible minister and made the teachers civil servants, but retained the secular-religious teaching in the same sense as before.

In *Victoria*, after its separation in 1851, two boards were created and the old dual control continued till 1862, when, by a common schools act the boards were dissolved in favour of a single board of education. This, however, failed to provide an equal distribution of facilities, and was abolished by the education act of 1872, a department of education being established under a minister. In *Queensland*, a board of general education, created in the second year (1860) of its independence, followed in the main the Irish national system. Besides the 'vested' unsectarian schools of the colony, 'unvested' schools, Anglican or Roman Catholic, were aided by grants. In 1875 the state education act abolished the board, and its powers were transferred to a department of public instruction under a minister. State aid was withdrawn from denominational schools in 1880. In *Tasmania* the first Anglican clergyman, Robert Knopwood, aided the Methodist immigrants of 1818 to establish schools. By 1828 there were 8 government schools, and by 1836 there were 29. Originally schools were established in connection with religious bodies, and assisted by state grants; in 1846 the system was to pay to denominational schools 1d. per day per head of pupils attending. By the education act of 1885 primary education passed to a special department under a minister. In *South Australia* the first school was established in 1836 on Kangaroo Island, where Captain Bromley taught the children 'under a large and beautiful tree' and subsequently in a hut. Up to 1875 the educational activities of the State were mainly confined to subsidizing private institutions, but in that year was appointed a council of education to provide state schools and compel attendance thereat. In 1878 its powers were vested in a minister of education. In *Western Australia* an elementary education act of 1871 provided for a central board of education controlling government schools; other schools were assisted by grants. The board was dissolved by an amending act in 1893, and its place was taken by a ministerial department of education. In 1895 assistance to non-state schools was abolished.

At the present date (1925) each State possesses a permanent head of the public educational system, known as 'director of education' (in Queensland as 'under-secretary'), whose business it is to control the whole service so far as it falls under the several education acts. In both Victoria and South Australia there also exists an advisory council of education, which offers reports and recommendations upon methods and developments and upon the co-ordination of the educational activities of their States.

In all parts of the Commonwealth there are to be found (*a*) primary 'state' schools (officially known in New South Wales and South Australia as 'public' schools), staffed by duly trained and qualified teachers working with a prescribed syllabus and under regular examination by inspectors, and (*b*) non-state schools of various descriptions, some denominational, some private. Domestic tuition is also permitted. The only point upon which all the States insist is that a proper education shall be given to each child, so far as it is possible to achieve that end—though, in view of geographical and other conditions, a certain elasticity is rendered inevitable in the matter of enforced attendance.

The compulsory school age-limits are 6 to 14

(in New South Wales and Tasmania 7-14), exemption being granted to pupils over 13 who have reached a qualifying standard. In some schools the lowest, or infant, classes are taught by modern kindergarten methods, but before reaching school age children are commonly dealt with by free kindergarten unions working on Froebelian or Montessori lines, the State assisting in the training of the teachers. Legally attendance at school is required on every occasion on which the school opens, unless sufficient cause be shown for absence. Excuses accepted as valid are (1) regular and efficient instruction elsewhere, (2) physical or mental disability, (3) excessive distance from a school, (4) such other pleas for non-attendance as may seem reasonable to the authorities. The distance considered excessive depends somewhat upon the age of the pupil, and is calculated by the nearest available route. Thus in South Australia it is 1 mile of walking distance for pupils between 6 and 7 years of age, 2 miles between 7 and 9, 3 miles between 9 and 14. The same rule applies in Victoria, except that 2½ miles are allowed between 9 and 11. In New South Wales it is 2 miles up to the age of 11, then 3 miles; in Western Australia the compulsory radius is 2 miles for children under 9, but 3 miles after that age. In Queensland the maximum is 3 miles. Every precaution is taken for ensuring regularity. Thus in Victoria 'no person shall within school hours employ or permit to be employed any child not legally exempt,' nor can any child be so employed before school hours if the profitable use of school time is likely to be endangered. In South Australia the penalty for the breach of a similar provision is a fine, maximum £5. Truancy, or allowance of truancy, is punishable by fine or imprisonment of the parent or other person on whom the onus rests. Head teachers are required to supply to their departments a full account of attendances, causes of absence, and statements of special circumstances. 'Efficient attendance elsewhere' has reference to non-state schools and domestic tuition. The terms on which these are accepted vary somewhat in the different States, but their general effect is the same; the department must be satisfied. Thus in South Australia the principals of private schools are required to keep rolls of attendance for pupils of compulsory age and to supply the same information as is demanded of the state schools. In Victoria 190 working days in the year are required of the private institutions. In Tasmania private tuition is accepted if the inspector of schools reports that the child is being properly educated. In New South Wales the proprietor or head teacher of any non-state school must prove to the satisfaction of an inspector of schools that regular, as well as efficient, instruction is being given and non-state schools must be 'certified;' otherwise they are not regarded as schools within the meaning of the act.

In respect of registration and supervision of non-state schools there is no uniformity among the several States. In Victoria private schools can only be established with the authorization of the registration board of the council of public education, which calls for proof of the qualifications and adequacy of the staff and the suitability of the buildings. In New South Wales there is no registration act for teachers, although principals may apply to have their schools placed on a registered list. Such schools may be inspected by the direction of the minister from time to time, and their certificates may be cancelled; an inspector or medical officer may enter to examine drainage, light, ventilation, etc. In Tasmania private schools are controlled by the teachers' registration board, which can approve or disapprove of their registration as schools. In South Australia inspection of a private school is made only on the request of the proprietor or principal. Except in Victoria and Tasmania the relations between state and non-state primary education, and the qualifications and classification of non-state teachers, seem badly, if at all, systematized. In the two States named every school is registered as 'sub-primary,' 'primary' or 'secondary,' or as any two or all of these. The registration board determines the right to any of these titles, and no person can conduct any school or teach in it unless it has been registered. It is presumable that in course of time the various systems will be brought more into line with each other.

In 1923 the numbers of pupils attending state primary schools were—South Australia 90,500; Queensland 129,139; Tasmania 31,552; Victoria 216,329; New South Wales (1922) 320,398. (The number for Western Australia is not forthcoming.) When compared with the total number of children of compulsory school age, these attendances amount to an average of over 80 per cent; the non-state schools and private tuition account for the remainder.

Primary education being compulsory, it has also been made free for the compulsory age. Though in the earlier days fees were exacted, the several States have sooner or later arrived at this common principle. The total abolition of fees dates in Victoria from 1873, in Queensland from 1875, in South Australia from 1891, in Western Australia from 1899, in New South Wales from 1906, and in Tasmania from 1908.

That the education publicly provided should be secular was an early resolve of most of the colonies. This decision arose from no hostility to religion, but from a due recognition of the claims of the various denominations and the necessity of avoiding conflicts. Nor does the system in practice prevent a proper teaching of religion. 'Secular' is mostly to be taken in the sense of undenominational and undogmatic, rather than of non-religious. So far as 'religious' teaching proper is concerned, attendance of the pupil is optional, and the several sects commonly make their own provision. But here again the States are not entirely of one mind. Thus in Queensland it was decided in 1910, as the result of a referendum poll, that teachers must include in their programmes the reading of Bible lessons selected from a special compilation of the department. While they are themselves debarred from inculcating the tenets of any particular denomination, instruction in that kind may be given by a clergyman in school-time for one hour per week to the children of his sect whose parents or guardians may wish them to attend. On the other hand, in Victoria no state teacher may give any instruction other than secular in any state-school building; but other persons may, by order of the minister, give religious instruction in the schools for half an hour on one or two days in the week, the attendance at such times depending on the wish of the parent or guardian expressed in writing. Full advantage of this provision is taken by the clergy and others under an elaborate organization of the council of the churches. In New South Wales denominational representatives have up to an hour of school time weekly at their disposal, and the 'secular' instruction of

the ordinary staff includes 'general' religious teaching. In South Australia no denominational religious teaching is allowed in any public school, but any primary school may open in the morning, before the time fixed for secular instruction, for the purpose of reading portions of the Bible in the authorized, revised, or Douay versions. In Tasmania the regular staff is required to give in school hours instruction in 'scripture history and morals,' such teaching being entirely non-sectarian and intended to 'inculcate an attitude of reverence and to create an interest in matters of spiritual suggestion.' Whether a child shall attend at 'sacred history' is optional with the parent; for the first or last half-hour in each day a clergyman may instruct the pupils of his own denomination. Though all this is so much compromise, there is no State which does not in some way attempt moral teaching, whether by Biblical lessons and narrative or by means of inspiring stories from history or some suitable reading matter.

The curriculum of the primary schools throughout the Commonwealth may fairly be described as liberal and 'up-to-date.' The subjects commonly included are reading, writing, grammar, and expression in English; arithmetic (written and mental), practical geometrical work, mensuration, and simple algebra; morals and civics; British and Australian history; geography; nature knowledge and elementary science; drawing and brushwork; manual work in simple crafts and modelling; singing; needlework for girls; drill for boys, and physical exercises for both sexes. At the close of a satisfactory primary course the pupil receives a 'qualifying certificate.' As it is a regular principle that every boy or girl should, as far as possible, find access to higher education up to and including the university, the path is made easy to industry and talent by the provision of numerous exhibitions and scholarships at each stage.

The geographical conditions of Australia being what they are, and the diffusion of its population being so wide and in many quarters so sparse, it has been a difficult matter to meet the educational needs of every family. Yet every reasonable endeavour has been made. When a school, though distant, is reachable by some sort of conveyance—train, horse-vehicle, or motor-vehicle—the States have for the most part met the expense, leaving to the parents the responsibility for the necessary arrangements. In New South Wales children are conveyed, when it is fairly practicable, to some 'central' school, free transport being provided on the state railways to the nearest, or concession rates being granted to those more remote. In Victoria an allowance of 3d. or 4d. per day is made for the transport of children to the nearest school, if it lies at a greater distance than those specified for a walking route. A similar arrangement exists in South Australia. Queensland permits children at an inconvenient distance from a school to travel free by train wherever there is railway communication. Tasmania allows up to 6d. per day for conveyance from a distance of 4 miles or more, or stationmasters may issue free passes to the nearest school. Nor is there any undue parsimony in the supply of schools in thinly populated districts. Thus in South Australia the department establishes one wherever an average of 6 pupils can be maintained. In New South Wales 'provisional' schools may be established where there are more than 10 in attendance, and 'half-time' schools where a smaller number can be collected. Victoria also provides full-time or half-time schools for groups of at least 10. In addition both New South Wales and Victoria subsidize, to the extent of £70 and £50 respectively, schools in which an approved teacher has been selected by parents in an out-of-the-way district. Meanwhile in Queensland, New South Wales, and Victoria 'itinerant' teachers proceed by car, cycle, etc., to deal with small groups or families in turn imparting instruction, advising, and leaving directions for work. The 'travelling' schools of New South Wales are vans equipped with all necessary school material, and move from family to family, returning in a regular circuit. In 1923 the Queensland government decided to build and equip two railway cars each 43 feet long, for teaching girls in out-back regions such subjects as cookery, house-wifery, laundry work and needlework. Each car remains at a stopping place from six to eight weeks. Girls over 12 years receive instruction for not less than four days in the week; in the more sparsely populated districts girls under 17 who have left school are also taught. Each week one day is given to a demonstration for adults. During 1924 the two cars visited 14 centres. Finally 'correspondence' schools in the capitals deal with isolated cases in the country, the education being mostly confined to 'the three R's' and performed by written work transmitted and corrected. As soon as the population becomes sufficiently close, schools are everywhere established. Nor are the aboriginals neglected. Thus in New South Wales the native children of school age are taught by specially trained teachers at aborigines' mission stations in various quarters.

The medical inspection of state schools, though not ungenerously treated, is in some cases said to need a larger staff. In New South Wales 8 medical officers (of whom 4 are women) examine every school child once in every 3 years; 11 travelling dental clinics deal with a conservative treatment of the teeth, and in sparsely settled districts a travelling hospital concerns itself with the eye-troubles which are frequently prevalent there. In Victoria 4 medical officers visit both the elementary and the high schools; to complete this service, arrangements are made with the public health commission for assistance from district health officers. Queensland employs local medical practitioners, who examine the pupils, make records of their physical condition, and suggest treatment; these are assisted by a staff of trained nurses; where hospitals exist the medical officer is engaged by the department to give his services without charge. Dental inspectors regularly visit the schools and perform operations gratuitously. In South Australia the scheme provides for inspection of all children twice during their school life, parents being notified of any defect likely to interfere with their progress; a dentist with a trained nurse visits the far back schools, mainly to educate the children in the care of their teeth; and lectures are given to teachers on hygiene and the prevention of disease. Tasmania employs full-time medical officers in the country and, in the towns, part-time doctors and full-time nurses.

Departmental officers administer the regulations applicable to a whole State, but the special interests of particular schools are watched by local bodies known as 'school committees' (Victoria, Queensland, South Australia), 'boards of advice' (Tasmania), or the like. These are commonly nominated or elected at a meeting of the parents and guardians concerned,

but are appointed by the minister. In New South Wales a 'public school board,' nominated by a parents' and citizens' association, may have under its care either a single school or a group. Such committees or boards have no part in the appointment of a teacher, and no power to interfere with the curriculum or methods; they are concerned only with the buildings, grounds, and minor requirements of a school and with any local complaints which may arise. They are expected to lend general support and protection to a teacher, and to assist him in securing a proper attendance of the pupils, but may also report to the minister upon cases of intemperance, gross immorality, or flagrant neglect of duty. In Tasmania they may meanwhile suspend a teacher for such causes.

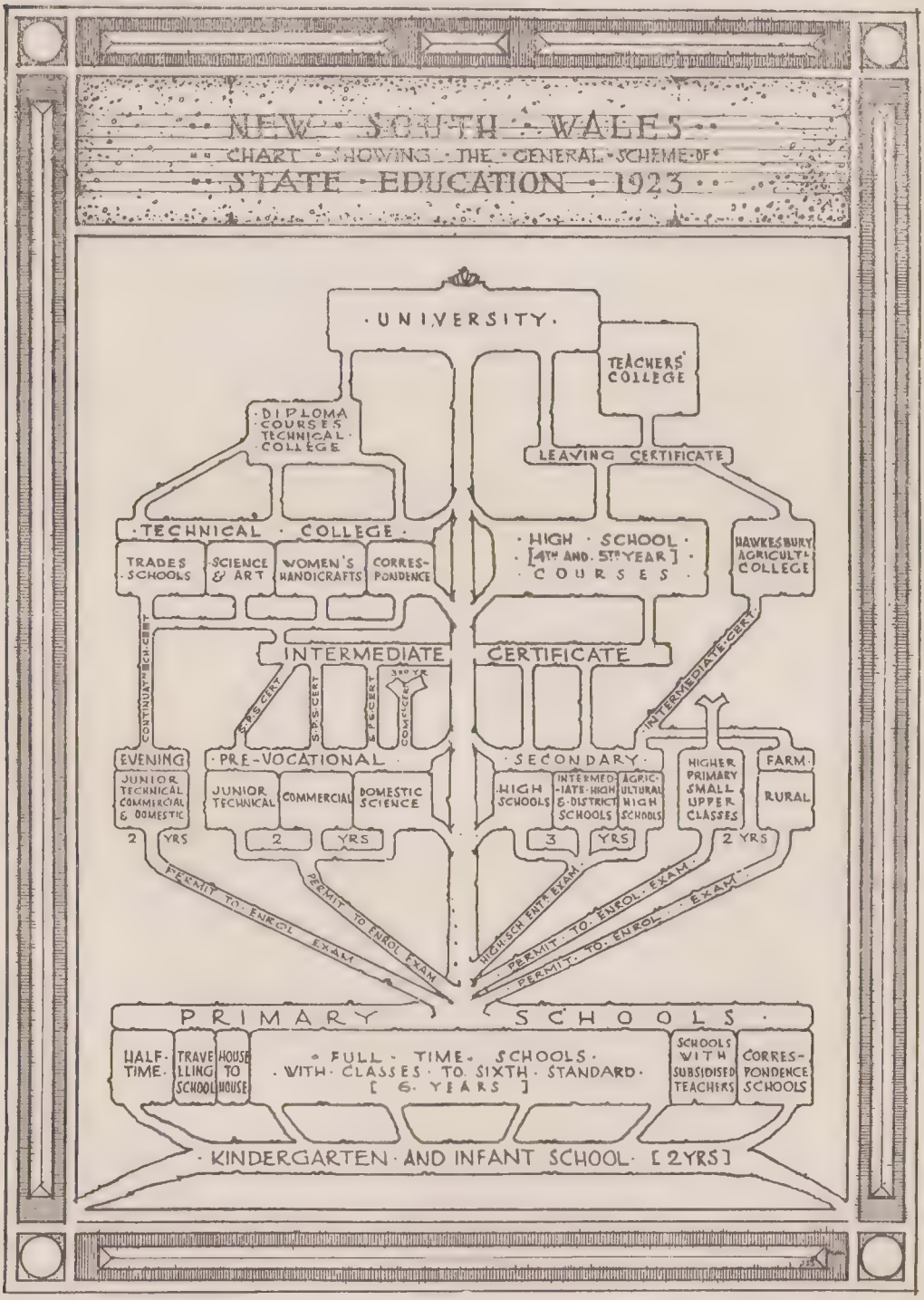
Secondary Education.—The provision of an efficient secondary education by the State is of comparatively recent growth in Australia, and even at the present day the larger proportion of such work is performed by non-state schools —styled 'grammar schools,' 'high schools,' 'colleges,' and the like—many of which are private enterprises. A considerable number are either endowed institutions controlled by councils appointed by the various denominations which founded and support them, or else schools subsidized under some body of trustees with public responsibility. Schools of the last two classes are generally classified as the 'public' secondary schools, the term implying an analogy to the great public schools of England, upon the model of which they are tending more and more to form themselves. The history of the origin and growth of these non-state schools is, for convenience' sake, given under SCHOOLS. In some cases such schools received endowments of land and building grants from governments at a date prior to the establishment of state high schools and colleges, the remainder of the necessary funds being derived from the private subscriptions of those interested. This was the case, for instance, in Victoria with the Church of England grammar schools of Melbourne and Geelong, and the Melbourne Scotch College, St. Patrick's College, and Wesley College. To such 'public' schools, though brought into the list under other circumstances, additions have been subsequently made. In New South Wales the greater schools of a 'public' type include the Sydney grammar school (undenominational, subsidized by the state, and managed by trustees), the Church of England grammar school at North Sydney, Newington College (Wesleyan), Scots College, The King's School at Parramatta, and St. Ignatius' and St. Joseph's Colleges (Roman Catholic). The Queensland system of endowed grammar schools (as at Ipswich) is mentioned below. For girls there exist everywhere non-state schools of a size and standing corresponding to those of the boys' schools, the majority being private ventures, but many denominational, with such titles as Church of England girls' grammar school, Presbyterian Ladies' College, Wesleyan Ladies' College; and there are also many Roman Catholic convent schools. Where a registration act is in full force, any non-state secondary school is brought under the same regulations with the primary schools as to graded qualifications and classification of its staff. Elsewhere the intervention of the state is of the slightest. The standard of work in Australian secondary schools is practically the same as that of similar institutions in Great Britain.

But with the growth of the communities, and the progressive conceptions of educational requirements, the state has tended increasingly to take secondary education into its own hands by the foundation of state high schools, technical schools or colleges, agricultural colleges, and similar institutions. Not only do these provide a full instruction of the grade and kind implied by their titles; they are for the most part rendered easily accessible by liberal exhibitions from the elementary schools, by very low fees where fees are charged at all, and by other allowances. State high schools exist in every State, whether as full high schools with a curriculum leading to the universities or as 'intermediate' or 'higher elementary' schools with a less extensive range. Thus the full course in South Australia, New South Wales, and Victoria is one of 5 years; the intermediate course may be of 4 years (Victoria) or 3 (New South Wales) or, in the 'higher primary' schools of South Australia, of 2. 'Intermediate' and 'leaving' certificates are issued according to the grade achieved. In general pupils gain admittance to state high schools on passing a qualifying examination from the lower schools, and are then usually of the age of 12 or 13. Numerous and substantial scholarships (160 in Victoria) or bursaries, awarded for merit in the qualifying examination, are tenable at state high schools, and in some States at other secondary institutions approved by the department. In Queensland there are also 10 subsidized grammar schools, established under an act of 1860 in districts where not less than £1000 had been privately subscribed. A condition of the subsidy is that they shall receive a certain number of winners of 'district scholarships' from state schools. Western Australia is comparatively ill-provided with state high schools, but in the larger centres the upper classes of primary schools are brought together into central schools, where special arrangements are made for higher work up to the age of about 16.

In addition to the ordinary high schools all the States possess technical schools (or colleges) for pupils proceeding to a business career or to vocations demanding some degree of craftsmanship. Thus (to take a single State) South Australia has technical high schools, junior technical schools, country technical schools, schools of arts and crafts, and apprentice trade schools. The 'rural' schools of Queensland deal with those who go on to manual arts, commercial work, or elementary agricultural science. In New South Wales technical education includes courses in 'home economics' (i.e. cookery, hygiene, dressmaking, and household accounts). Agricultural colleges or schools exist in all the States of the mainland, and in Victoria 9 district high schools have farms attached for instruction in theory and practice. In Tasmania certain high schools include an agricultural course. See AGRICULTURAL EDUCATION.

Every endeavour has been made to distribute these secondary institutions fairly in each State. Thus, to take a single typical example, Victoria has 45 higher elementary schools (44 in the country), 33 high schools (27 in the country), and 27 technical schools (14 in the country). Of the 17 technical colleges of Queensland each important town has one. Of the 23 high schools of South Australia, 19 are in the larger country centres. In the matter of fees the States differ but slightly. For the most part instruction is free, but fees are sometimes payable in more special schools or advanced grades, e.g., at the South Australian school of arts and crafts and, on a lower scale, at the country technical schools.

In Victoria low fees are paid after the age of 14 at the high schools and junior technical schools, and those at the senior technical schools depend upon the subjects taken.



The 'Educational Ladder' in New South Wales.

A liberal number of bursaries, scholarships, and exhibitions are awarded from the secondary grades to the universities. New South Wales annually awards a number of bursaries as well as 200 exhibitions, the latter entitling the holder to exemption from all fees for matriculation, tuition, and degrees. For both bursaries and exhibitions a pupil from a non-state school may

compete, provided that the school has been registered with the department as competent to give instruction up to the required standard. Victoria offers 42 'senior' school scholarships at the university, and 70 'free places.' Queensland awards for distinction in the university senior examination 20 scholarships, which carry with them free tuition and £52 per annum if the student must reside away from home, £26 otherwise. Tasmania has 5 or 6 bursaries.

The pupils attending high, technical, and agricultural schools in 1923 were—South Australia, 11,451; Queensland, 15,651; Tasmania, 1708; Victoria, 31,474; New South Wales ('secondary and super-primary'), 32,422. Figures for Western Australia are not forthcoming.

Training of Teachers.—The teachers in the state institutions are civil servants under the education departments, and are paid according to a fixed scale of classification and promotion. Entrance to the service depends upon the regulations of the several States. In New South Wales a candidate may either enter the training college, or tender satisfactory evidence of teaching experience and training in a teachers' college elsewhere. In the college he may take either a 'long course' of from 2 to 4 years or a 'short course' of a single year, those who take the latter being generally sent as assistants to country schools or to take charge of small ones. The college has 600 places, of which the majority are reserved for students who have pursued a full course in the high schools. In Victoria candidates are drawn from high and other secondary schools. In most cases they begin as junior teachers on the staffs of the larger schools, and are trained in theory and practice by the headmaster. After a year's service they may apply for admission to the teachers' training college for courses of from 1 to 4 years. Juniors not entering the college are eligible for promotion after completing the junior teacher course (usually 3 years). Under the registration act all teachers in any school, non-state included, must give evidence of ability to teach. In South Australia a teacher must enter the training college for from 1 to 4 years; a single year suffices for the less important posts in primary schools, 2 years for ordinary primary positions, 3 or 4 years for those in a high school. In Queensland young teachers are still employed (usually for 4 years) as 'pupil teachers' in primary schools, but the number of these entrants is declining. Ex-pupils of secondary schools receive preference, and undergo a shorter probation. A teacher is 'classified' after examination and satisfactory evidence of ability. Others proceed to a training college, which provides scholarships. Tasmania also has its training college. T.G.T.

Eels (family Apodes). About 50 species occur in Australian seas, being most plentiful in the coral regions of the tropics. Many are remarkable for their bizarre coloration and marking. The reef eels (*Gymnothorax*) are commonly regarded as marine snakes, and some larger species are feared by divers because of their ferocity and power to inflict severe wounds with their large and sharp teeth. Marine species live in the crevices of rocks and reefs, but the freshwater eels (*Anguilla*) are more partial to a muddy environment. Larval eels differ much in appearance from the adults, having broad, flattened, transparent bodies, with very small heads. In their development towards the adult form they decrease in size as they acquire the typical cylindrical shape. Freshwater eels breed in the sea, to which they generally migrate during periods of flood. The young congregate at the mouths of rivers, and in making their way upstream surmount many obstacles that would appear sufficient to bar their progress. They even leave the water and cross land, moving in wet grass in order to migrate from one stream to another. A.R.McC.

Egrets. See Herons, Egrets and Bitterns.

Egypt. See Honey-eaters.

Egyptian Bindweed. See Ipomaea.

Eight-hour System. The first mention of an eight hours' working day in Australasia was made in 1847, in the articles of association for the settlement of Otago in New Zealand; but the clause guaranteeing this time-limit was withdrawn, though the agreement was tacitly kept. Towards the close of 1848 surveyors and their parties in the employ of the Otago Association were called upon to work nine and ten hours, but the settlers resisted. A mass meeting was summoned by a settler, S. Shaw, and it was unanimously agreed that the men should work for eight hours only; the trouble was ended by the opportune arrival of an English settler, Valpey, who immediately announced his intention of absorbing all available labour and maintaining an eight hours' working day.

In New South Wales in 1855 there were in existence a few trades organizations, one of which was the Operative Stonemasons' Society. At a meeting of this society, held in the Parramatta Hotel on 22 September 1855, a certain Hugh Laundry proposed 'That in the opinion of this Society eight hours should be the maximum of a day's labour.' This was carried unanimously, and almost all Sydney contractors at once conceded the boon. Messrs. Tooth Brothers, however, who were then building their Parramatta-street brewery, objected; the society at once withdrew its members (the greater number of whom were immediately absorbed by the contractor for the Parramatta waterworks), and in less than a fortnight all opposition was withdrawn.

The operative stonemasons of Melbourne moved in the matter early in 1856, and after several trade meetings and a conference with employers, decided at a monster meeting at the Queen's Theatre on 26 March that the system should come into force on the following 21st of April. The first procession was held on 21 April (a date since commemorated annually). In 1857 nine trades and about 700 men took part in the procession: the eight-hour system was rapidly extended, and in 1870 the government made it the official working day in government contracts. The factory act of 1873 ordained that no woman or girl should work for more than eight hours a day, and in 1877 the limitation was extended to all employed underground in mines.

Queensland followed the Victorian example, and celebrated the inaugural eight-hour festival in 1866, the pioneer trade again being the stonemasons. The first Sydney festival was held in 1871 by four eight-hour trades—bricklayers, stonemasons, labourers, and carpenters. In South Australia the establishment of the system was accomplished in 1873, the building trades (stone-cutters, painters and carpenters) being the leaders. In New Zealand the first trades congress was held in 1885, and in the same year there was a general celebration of the eight-hour principle by the combined trades. Trade

unions were first established in Tasmania in 1874, the shipwrights of Hobart being the pioneer society, and an eight hours' day one of the chief aims: as in Sydney, it was conceded after a strike. The inaugural celebration took place in 1890, the 26th of February being the day set aside. In Western Australia unions were formed soon after the discovery of gold, and 'eight hours' was established as the work-limit in 1896.

See Murphy's *History of the Eight Hours Movement* (1896); Spence's *Australia's Awakening* (1909); and the same author's *History of the Australian Workers' Union* (1911).

Elaeagnaceae, a small family of plants, chiefly Asiatic and European; a few species are American, and one species of the genus *Elaeagnus*—to which the oleaster belongs—is indigenous to Australia, while extending to India. This is *E. latifolia,* a Queensland species, a tall climber with clusters of small greenish flowers; the fruit is succulent, acid and somewhat astringent, and makes good tarts. Several exotic species are grown in Australia as ornamental garden plants.

Elaeocarpaceae, a family of trees or shrubs found in tropical or subtropical regions. The largely Asiatic genus *Sloanea* is represented by four species endemic in Australia. *S. australis* (Maiden's Blush), is a small tree with showy flowers, found in the coastal brush forests from Illawarra in southern New South Wales to Queensland, and known as 'kerabin' by the aborigines of northern New South Wales; it has a soft but durable timber, of a delicate rose colour when freshly cut, but fading into a light yellowish-brown; it is used for ornamental cabinet work. For the name-genus, *Elaeocarpus,* see BLUEBERRY.

Elder, SIR THOMAS (1818-1897), born at Kirkcaldy in Scotland in 1818, was trained for commercial pursuits and in 1841 aided his father to establish in England a branch of the firm—Elder & Co.—which his brother Alexander had just founded in Adelaide. In 1854 he migrated to South Australia to take over the management of the firm, which his brother had vacated, and shortly afterwards reconstructed it as Elder, Smith & Co., bringing in his brother-in-law Robert Barr Smith (q.v.) as a partner. The firm at once developed its operations in several directions, on the one hand financing the Moonta copper-mines and on the other occupying several thousand square miles of pastoral country and extending the area of settlement into previously unknown regions of the colony. This drew Elder into the work of exploration, and he actively encouraged nearly all the expeditions that between 1864 and 1894 penetrated the wilds of central Australia, especially those of Warburton, Gosse, Giles, and Lindsay (see EXPLORATION BY LAND). Apart from the supply of funds his most important form of help was the importation of camels (q.v.), which he acclimatized and bred at Beltana. His benefactions to South Australia were great. In 1874 he endowed the university of Adelaide with £20,000, and in 1884 gave £10,000 to the medical school, also contributing to the foundation of the chair of music, and founding a scholarship for graduates of Adelaide at the royal college of music, London. His will bequeathed to the university another £65,000. His gifts to the local museum, national gallery, and zoological gardens were valuable. He was an expert horse-breeder, importing valuable bloodstock from England, and until 1884 bred racehorses. He took little interest in politics, though in 1863-9 and 1871-8 he was a member of the legislative council. He died at Mount Lofty on 6 March 1897. (Kt. Bach., 1878; K.C.M.G., 1887; G.C.M.G., 1888.)—His elder brother Alexander (1815-1885) migrated to South Australia in 1839, founded the firm of Elder & Co. in 1840, and in 1853 returned to England, where he converted the London branch of the firm into an independent body and managed it until his death on 5 September 1885. In 1851-3 he represented West Adelaide in the legislative council. T.G.

Electric Rays or Numb-fishes, members of the family Narcobatidae, which includes a considerable number of species armed with organs for producing electric discharges. These are embedded in the soft flesh on each side of the head, and are composed of some hundreds of vertical, hexagonal cells, filled with a jelly-like substance, the ends of which are in contact with the integuments above and below. Their discharge has all the properties of electricity, producing a spark, rendering a needle magnetic, etc.; it is produced voluntarily, and evidently serves both to scare off would-be enemies and to stun and kill prey. A specimen of a common Australian species (*Hypnarce subnigra*) was observed to deliver 50 successive discharges within a space of about 10 minutes; these were intense at first, but gradually became weaker until they were scarcely perceptible. This species is plentiful in shallow waters on all coasts south of the tropics, and attains a length of over two feet. Two others occur in deeper waters, where they are occasionally taken by trawlers, together with a small species (*Narcine tasmaniensis*) that is represented in almost every haul of the trawl on the south-eastern coasts of Australia. A.R.McC.

Elephant Fish (*Callorhynchus millii*) is a ghost shark of the order Holocephali, characterized by a remarkable structure on the snout which somewhat resembles a short trunk. It is not uncommon in Victorian and Tasmanian waters, and is plentiful in New Zealand, where two tons of specimens have been taken in a single haul of a trawl-net. Though generally despised, the flesh of these fishes is quite palatable. Several species are known from southern oceans, all of which produce remarkable egg-cases surrounded by a broad flat expansion of horny texture. A.R.McC.

Elkhorn. See FERNS.

Ellery, ROBERT LEWIS JOHN (1827-1908), born at Cranleigh in Surrey on 14 July 1827 and trained for the medical profession, in 1851 migrated to Australia under the lure of the goldfields. Already interested in astronomy, he soon called public attention to the need of some institution where chronometers could be tested and nautical instruments adjusted for navigation in Australian waters; the Victorian government in consequence established an observatory at Williamstown, and made Ellery its first superintendent. His work in this connection is described under ASTRONOMY, q.v. From 1856 to 1874 he was director of the geodetic survey in Victoria. He took a prominent part in public life, especially in advancing the interests of education and science; he helped to found the Royal Society of Victoria (over which

he presided from 1856 to 1884), was a member of council of the university of Melbourne for many years, and a trustee of the public library; in 1873 he organized a local corps for signalling and torpedo work (which afterwards became the submarine mining engineers), and commanded it until 1889, retiring with the rank of lieutenant-colonel. In 1868 he was made a fellow of the Royal Society of London. He gave up his position as government astronomer in 1895, but maintained an active interest in the work, and lived practically next door to the observatory in the Melbourne domain until his death on 14 January 1908. (C.M.G., 1889.)

Emancipists, a term applied during the first half century of Australian history to men who had been, but no longer were, convicts, whether they had regained their freedom on the expiration of their sentences or (and this was the narrower connotation of the term, the first-mentioned class being technically 'expirees') had been granted an absolute or conditional pardon by the governor. Emancipists were thus distinct from free men on the one hand and convicts on the other. In principle emancipation was an act of grace based on the good conduct of the recipient; in practice it was often a reward for some particular service rendered. In the early days there was no definite rule for the mitigation of sentences. Macquarie decided to grant an absolute pardon only after 15 years' servitude in the case of a life sentence, or three-quarters of any other period to be served; and a 'conditional' pardon (the condition being continued residence within the colony) only after 10 years for a life sentence, or two-thirds of any other period to be served. This regulation—which was not strictly observed, even by Macquarie—had been made necessary by the increasing number of applications for relief. By 1820 out of a total population of 24,939 there were 1121 pardoned convicts, who with the 3255 expirees formed the bulk of the lower middle-class of the community. Phillip had been instructed to grant 30 acres of land to each emancipist, with a further grant if he were married; free rations were also issued for some months, and the loan of tools was provided for. But though some emancipists prospered on the land, others, untrained to agricultural work, or shiftless, sold their property soon after receiving it—despite the condition of five years' residence —or worked it so wastefully that it was soon exhausted. Bigge therefore recommended that land be granted only to emancipists who had accumulated a small capital. By 1820 emancipists held approximately 35,000 acres by grant and 50,000 by purchase.

Though some emancipists achieved considerable wealth, they found it of little value in crossing the gulf that separated free and freed —a distinction that 'cut deep into the social, economic and judicial structure of the colony.' A few emancipists were men of superior mental attainment, whose capacity demanded opportunity for development and expression; yet before Macquarie's arrival they were (with two exceptions) excluded from colonial society. Macquarie believed that freed men should have the opportunity of re-establishing themselves in society and be eligible for any situation for which, by a long term of upright conduct, they might prove themselves worthy. Soon after his arrival he gave practical effect to this belief by appointing two emancipists to the magistracy, and subsequently another two, despite the continued opposition of many officials and free settlers. Meanwhile his support of emancipist attorneys—among whom George Crossley was the most prominent—led to a serious dispute with Jeffery Bent (q.v.), the first judge of the supreme court. On the opening of the supreme court in 1815 Crossley, who had been allowed to practise in the previously existing courts of civil jurisdiction, entered a plea for access to the new court. Bent disallowed the plea on the ground that men struck off the roll in England could not properly continue to practise in an English colony. The two magistrates who sat with him were not prepared to support him, though two free attorneys, specially encouraged to migrate, were on their way to the colony. Bent therefore refused to constitute the court, which remained closed for two years. Macquarie also gave social recognition to a few leading emancipists, and invited them to his private table and society. This antagonized the military officers, who were the centre of all social gatherings in the young colony; it had been comparatively easy to dominate those of his own regiment (the 73rd), but on its recall in 1814 the officers of the 46th—and later the junior officers of the 48th—refused to admit emancipists into their company at the governor's bidding, and made the social barrier more rigid than ever. Macquarie's effort to secure the social re-establishment of emancipists was thus without much effect.

When Brisbane took charge of the colony, no emancipist magistrates sat on the bench. He had been warned by the colonial office that, although the principle on which Macquarie had worked was right, it was inexpedient to rouse the opposition of well-to-do free men by forcing it upon them without careful discrimination. In any case Brisbane took little part in social controversies, and his frequent disregard of official duties tended to increase the power of the official and free class—especially as during his term of office the attention of emancipists was concentrated on an effort to free themselves from certain unexpected legal disabilities. Before 1817 it had been generally assumed that the governor's pardon had the same force as a pardon issued under the great seal of England, and restored the party to all the privileges of a free subject. But the court of King's bench in 1817 decided that a governor's pardon had only the force of a pardon issued under the sign manual, the emancipist remaining in law a 'convict attainted' without power to maintain personal actions or acquire, retain or transmit property. This decision became effective in the colony in April 1820, and in January 1821 the emancipists held a meeting to petition the crown to remove these disabilities—the chairman and secretary of the meeting being sent to England to present the petition and urge its claim. Bigge supported them in this connection, and in the New South Wales act of 1823 a provision was inserted declaring that pardons already granted had the force of pardons under the great seal, though future remissions would have that effect only within the colony.

Brisbane before his departure for England accepted an invitation to a farewell dinner given in his honour by emancipists—an act which, in Darling's opinion, roused again their social ambitions and rendered them more susceptible than ever to the propaganda of the radical leaders—Wardell, Wentworth and their colleagues. With the growth of a popular party (consisting of the poorer free men, the colonial-

born, and the emancipists) during the later twenties and thirties, the political connotations of the word 'emancipist' gradually disappeared. But they died hard; the division of colonial society into 'exclusives' and 'emancipists' was still referred to by Bourke during his governorship, and proved a difficulty in the way of his extension of the jury system—it being argued, just as before trial by jury was allowed in any measure, that a free man tried by freedmen was not being tried by his peers.

The term 'emancipist' disappeared finally with the abolition of transportation, though the class to which it referred had already merged into a larger group.

'Emancipist' was from the first an officially recognized term for prisoners who had received a pardon before the expiration of their sentence, and later for all freedmen. The terms 'exclusive' and 'exclusionist,' often applied to those—usually officials, military men or free settlers—who opposed the admission of emancipists to full civic rights, never gained official recognition. They appear to have arisen about the beginning of Darling's term, probably as a nickname invented by Wentworth or his followers for propagandist use. Peter Cunningham in 1827 mentions 'exclusionists' as a word in common use. But officially the anti-emancipist party was known as 'free settlers;' Darling in 1825 calls them 'the old settlers,' and Bourke as late as 1833 calls them 'Emigrants'—a very misleading name.

Embids. See ISOPTERA.

Emeralds. See GEMSTONES.

Emperor Breams, tropical fishes of the family Lethrinidae. Species of the large genus *Lethrinus* are called 'island snapper' at Lord Howe Island and Norfolk Island, 'pig-faced bream' and 'sea bream' in Queensland, and 'yellow-mouthed sea perch' in New South Wales. They are valuable food-fishes, always prized by fishermen, and as they dry well in the hot sun of the tropics are particularly useful as a standby when fresh fish is not obtainable. They attain a large size, and are characterized by broad, scaleless cheeks and more or less pointed snouts, which give them a somewhat pig-like physiognomy. They are often very brilliantly coloured, and commonly live among coral reefs, where they find an abundance of crabs and shell-fish upon which to feed. A.R.McC.

Emu, a large flightless bird (*Dromaius novaehollandiae*), the sole living species of the family Dromaiidae, which with the cassowaries (Casuariidae) constitutes the order Casuariiformes, peculiar to the Australian region, and characterized by the structure of the feathers, which have a double form, as if two sprang from a single shaft; this is due to the fact that the aftershaft—which in other birds exists as a minute branch of the feather—is almost or quite as large as the main shaft.

The whole body of the emu is covered with brownish-black feathers. The small wings and rudimentary tail do not bear any specially large quills, resembling in this respect those of the New Zealand kiwi alone among living birds. The head and upper part of the neck have only a sparse clothing of short, black, hair-like feathers, which do not obscure the bluish colour of the skin of the neck.

The emu lays from 7 to 18 eggs in a depression in the ground, sometimes lined with grass, sticks, or leaves. The eggs are dark green, with a granulated surface, 5 to 5½ inches long and 16 to 24 ounces in weight. The breeding-season extends from April to November, and incubation—in which both sexes usually share—takes from 2 to 3 months. The chicks are sooty-black, with broad, white, longitudinal stripes. The adults make a deep drumming sound. Their food consists of grass, leaves, berries, and fruit.

Emus occur throughout Australia, except in the dense tropical scrubs of the east coast and

Emu.

the more settled districts—where they have been exterminated. They also formerly occurred in Tasmania, the insular race having been rather smaller than the mainland bird, with a lighter breast. Of the Tasmanian emu, which became extinct about 1860, only two specimens have been preserved, both in the British Museum.

When Australia was discovered distinct species of emu, of smaller size than the Australian, existed on King Island in Bass Strait, and on Kangaroo Island off the coast of South Australia. Both species were exterminated early in the 19th century by the settlers and sealers, who captured great numbers for food. Of the Kangaroo Island Emu (*D. peroni*) a single skin and two skeletons are preserved, in museums at Paris and Florence; the King Island Emu (*D. minor*) is known only from bones picked up on the island, and from the brief accounts of one or two early visitors to the island.

Footprints of the emu were seen by the Dutch explorer, Willem de Vlamingh, on the west coast in 1696; but the first specimen met with by Europeans was killed in February 1788, within half a mile of the present Sydney railway station, by a convict employed in shooting animals for Governor Phillip. The officers who examined it decided that it most nearly resembled the emu described in Goldsmith's *History of the Earth and Animated Nature*, the name being used by Goldsmith for the South American ostrich, or rhea; the bird was therefore named the New South Wales emu. The word emu is derived from the Portuguese 'ema,' a crane, and was at that period frequently used for any large bird, especially for the ostrich, cassowary, and rhea. It is now restricted to the Australian bird.

The emu is regarded as the typical bird of Australia, and with the kangaroo appears as a 'supporter' on the Commonwealth coat of arms. It was formerly figured on the twopenny postage stamp of New South Wales, and at

present appears to the right of King George's head on Australian postage stamps of various denominations. During the world-war a bunch of emu feathers worn in the hat was the badge adopted by the Australian Light Horse.

W.B.A.

Emu-berry. See PINES.

Emu-bush. See EREMOPHILA.

Emu Wren. See WRENS.

Endiandra, a genus of the family Lauraceae, consisting of trees with large globular fruits. It extends to Malaysia and India. The 15 species indigenous to Australia are confined to New South Wales and Queensland. *E. virens* (White Apple) is a tree of 40-50 feet with large whitish fruits; *E. Sieberi* (Cork-wood), reaches a height of 60-70 feet, and has a rough corky bark. The fruit when ripe has a lustrous blue colour, varying to purple, and is a favourite food of wood-pigeons. *E. glauca,* a 'teak,' growing up to 70 feet, has a handsome dark-coloured timber of aromatic fragrance.

Entada, a tropical genus of the family Leguminosae; one species, which is common in Asia, is also indigenous to Australia. This is *E. scandens* (Queensland Bean, Matchbox Bean), a strong woody climber that festoons the largest trees. The leaves have a common leaf-stalk 2-6 inches long, terminating in two tendrils (not always developed), which bear two pairs of leaves, each again divided into leaflets; pods woody (2-4 feet long, 3-4 inches broad) flat, and constricted between the seeds; seeds 10-30, nearly 2 inches in diameter. It is largely a coastal species; an air cavity in the seeds enables them to float in salt water for a long time without losing their power of germination. The large beans are eaten by the aborigines after a process of baking, pounding, and soaking; their dark-brown shell is hard and polished, and is used in both India and Australia for making ornamental boxes. The kernels are used by the Nepaulese for a hair-wash, and in Bengal for crimping linen.

Epacris, a genus of the family Epacridaceae, consisting of flowering shrubs. It contains 30 species, limited to Australia and New Zealand; 19 are found in New South Wales. The corolla-tube is cylindrical or bell-shaped, with five more or less spreading lobes; anthers wholly or partially enclosed in the corolla-tube; fruit a 5-celled capsule. The species are known generally as 'Australian heaths,' and are distinguished from the true heaths (*Erica*) by the epipetalous stamens and the form of the anther. *Epacris longiflora* (Native Fuchsia—a popular name shared by other plants) has handsome sprays of parti-coloured, drooping flowers, shading from crimson to white. It was grown and flowered in England in 1806. *E. paludosa* and *E. obtusifolia* (the latter with sweetly scented flowers) are swamp dwellers. *E. crassifolia* when growing on the seacoast is a robust plant with relatively large, coarse leaves; on the higher slopes of the Blue Mountains it grows in shady gullies, in the crevices of dripping rocks, and is a soft, matted plant with small leaves. A double-flowering variety of a handsome shrub, *E. onosmaeflora,* found by Allan Cunningham near Blackheath in the Blue Mountains, was raised at Kew gardens in England. The following species are endemic in the Blue Mountains: *E. rigida,* which grows on barren stony hills; *E. reclinata,* on dripping rock ledges in shady gullies; *E. apiculata,* a rare species found only on the higher elevations; and *E. Hamiltoni,* only found in a swampy area near Medlow, which has the softest foliage known in the genus.

Epacris longiflora.

Epacridaceae, a family of heath-like shrubs (rarely trees) largely indigenous to Australia, with representatives in New Zealand, Malaysia, and Oceania, and one species as far away as alpine South America. Over 300 species and 25 genera are known in Australia, divided into two large groups by their fruits; the Stypheliae, which bear drupes, and the Epacreae, which bear capsules. The flowers are white or red, occasionally blue, green, or yellowish. Many species are grown in European conservatories, to which they were introduced by early botanists.

Richea Gunnii.

The genus *Pentachondra* extends to New Zealand. The species are all diffuse or prostrate alpine undershrubs. *Acrotriche* is an endemic

genus of low shrubs, with insignificant greenish flowers and small red berries. *Richea*, the largely Tasmanian genus found only in alpine regions, is represented on the mainland by *R. Gunnii*. *Melichrus* is an endemic eastern genus of two species. See ASTROLOMA, DRACOPHYLLUM, EPACRIS, LEUCOPOGON, LISSANTHE, MONOTOCA, SPRENGELIA, STYPHELIA, TROCHOCARPA.

Epiceratodus. See CERATODUS.

Eremocitrus, a genus of the family Rutaceae, endemic in the drier parts of New South Wales and Queensland. The single species, *E. glauca* (Native Kumquat or Desert Lemon), was formerly placed under *Atalantia*. It is a rigid shrub or small tree, often armed with straight or recurved spines half an inch long. The young shoots are whitish with minute hairs; leaves thick, veinless, oblong, 1 to 1½ inches long. From the fruit—a globular berry about half an inch in diameter—a fairly good preserve is made, and an agreeable beverage may be made with its acid juice. This plant has a close-grained, bright yellow timber, with numerous brown streaks or veins; it takes a fine polish. Experiments are being made with the object of establishing a race of citrus plants with increased resistance to cold.

Eremophila, a genus of the family Myoporaceae, consisting of shrubs with solitary or few flowers in the leaf axils, comprises 91 species, all endemic in Australia. The calyx is divided into 5 segments; corolla-tube elongated and incurved, the upper portion obliquely two-lipped; stamens 4, in 2 pairs, often protruding; fruit dry or succulent. *E. maculata* (one of the so-called native fuchsias) is regarded as poisonous by some pastoralists and as a good fodder-plant by others; it is most dangerous when in fruit, and its effects always worst after rain. *E. longifolia* (Emu-bush—the emus feed on the fruit), the 'berrigan' of the aborigines of the interior, has a very brittle timber. Its leaves and bark yield a fair percentage of tannic acid, and are greedily eaten by cattle and sheep; it is said to be one of the first trees barked by rabbits during a drought. *E. Mitchelli* (Bastard Sandalwood) has a hard, brown, beautifully grained timber, with an aromatic odour resembling that of sandalwood; it provides handsome veneers for the cabinet-maker, and is said to be free from the attacks of insects. The leaves are relished by stock. The bruised leaves of *E. oppositifolia* (also called Emu-bush) are used by aborigines in the western districts for tanning wallaby and other skins used for carrying water.

Eriostemon, a genus of the family Rutaceae, consisting of showy flowering shrubs, usually found in poor sandstone country. The flowers are commonly pink or white, with a 5-cleft calyx and 5 imbricate petals; stamens 10, with hairy filaments; fruit carpels 5, the valves opening elastically and scattering the seeds with an explosive action; leaves with prominent oil-glands. There are 17 species, largely endemic, found in all States of the Commonwealth. *E. myoporoides* is cultivated as an ornamental garden plant. On a hot day the explosion of the ripe fruits gives the effect of distant rifle-shooting. *E. obovalis* is a cool-country species; *E. hispidulus, E. scaber* and *E. buxifolius,* low shrubs, are common on rocky

Eriostemon salicifolius.

ocean headlands and coastal sandstone country; *E. salicifolius* is very common in the Port Jackson district.

Eryngium, a genus of the family Umbelliferae, consisting of herbs with prickly leaves and flowers in compact heads or spikes surrounded by a ring of narrow prickly bracts. It is widely distributed in warm and temperate regions, and most abundant and varied in South America. Of the 4 species indigenous to Australia 2 are endemic. The calyx-lobes are rigid, with acute points, often prickly; petals with a much-inflexed long apex; fruit turgid, rough, and without oil receptacles. *E. rostratum* (Blue Thistle) has a rather striking appearance, but its tendency to spread, and the difficulties attendant upon its eradication when established, cause it to be regarded as a weed. Several exotic species are cultivated as ornamental garden plants, under the name of 'sea hollies.'

Erythrina, a genus of the family Leguminosae, consisting of trees or shrubs armed with conical prickles, widely dispersed and largely tropical. The flowers are large, usually red, in lateral clusters of 2-3 along the flower stem; pod 2-valved, slightly constricted and pithy between the seeds. *E. indica* is the Indian Coral-tree,' which ranges from northern New South Wales to northern Australia, and extends to India. It is largely cultivated as an ornamental tree; its soft porous wood is used for making toys, light boxes, etc., which are usually overlaid with a thick coating of varnish or lacquer. *E. vespertilio* (Bat's wing, Coral, from the shape of its leaves) has a soft, light wood from which

the aborigines make shields; they also use the hollowed logs as canoes.

Erythrophloeum, a small genus of the family Leguminosae, consisting of trees with mimosa-like leaves and small flowers in elongated cylindrical spikes. It has one species indigenous to Australia, and 2 in tropical Africa. *E. Laboucherii* is probably the 'leguminous Iron-bark' mentioned by Leichhardt in his *Overland Journey to Port Essington* (p. 242). It has a reddish wood, close-grained and very durable, said to be the hardest wood in Australia.

Esmond, JAMES, known as 'Happy Jim' while driving the coach between Geelong and Buninyong, left Victoria in 1848 for the Californian goldfields, where he succeeded in making wages only, and whence he returned to Sydney in 1850 on the same ship as E. H. Hargraves. Making his way back to Victoria he joined a timber-cutter in the Pyrenees, and while thus engaged met a Dr. Bruhn who advised him to look out for gold. Esmond accordingly, after examining the banks of Deep Creek, found gold on 1 July 1851 on the northern side of a hill opposite Cameron's station at Clunes, and made known his discovery in Geelong five days later. For his discovery the Victorian legislature awarded him £1000. See GOLD, DISCOVERY OF.

J.C.

Estuary Perch. See FRESHWATER PERCH.

Etching. See ART.

Eucalyptus, a genus of plants of the family Myrtaceae, endemic in Australia and Tasmania. Its species (350 in number, besides some doubtless as yet undescribed) are widespread and abundant; while *Acacia* has more species, *Eucalyptus* has probably more individuals than any other genus known to science. It was founded on a specimen collected by David Nelson in 1777, during Cook's third voyage of discovery. William Anderson, the naturalist attached to Cook's second expedition, had noticed the Tasmanian 'gum-trees,' and had used to distinguish them the generic name *Aromadendron*; but Nelson's specimen (from Adventure Bay) was the first to be botanically described, L'Héritier in 1788 giving it the name *Eucalyptus obliqua*—now commonly known as messmate or stringy-bark. The generic name refers to the excellent shelter provided for the young blooms by the lid (operculum) which characterizes the genus; the specific name connotes the irregular growth of the leaf on the two sides of the midrib. Robert Brown in 1814 affixed to the genus the name *Eudesmia*, but *Eucalyptus* undoubtedly has the prior claim.

Apart from the operculum—which represents the petals—the genus is characterized by exceptional variation, seedlings, juvenile and mature foliage, buds, anthers, fruits, bark, and timber all developing extremely divergent forms. The flowers are usually white or cream-coloured, but a few species from Western Australia show crimson, scarlet, or yellow blossoms. Those of *E. ficifolia*, for instance, vary from pink to a dark crimson, with occasional divergence into white (the whole series of colours can be seen along the famous avenue in the King's Park at Perth); those of *E. macrocarpa* and *E. pyriformis* are red, of *E. miniata* orange-coloured, of *E. Preissiana* bright yellow. Another characteristic of the genus is the formation of well-marked 'suckers' or adventitious shoots; in most species the sucker-leaves, which represent juvenile foliage, differ considerably in form from the mature leaves, and are a valuable aid in identification. Two groups of eucalypts may be clearly differentiated by size only, the forest trees and the stunted mallees. The former may attain gigantic proportions; the remains of a Blackbutt (*E. pilularis*) near Bulli in New South Wales approximated 20 feet in diameter, monster Tallow-woods (*E. microcorys*) were found on the Lansdowne River, and specimens of the Mountain Ash (*E. regnans*) have in Victoria reached a height of 325 feet—the tallest in Australia. Some of the Karris (*E. diversicolor*) of Western Australia may closely approach this height, but no satisfactory records are available. The majority of eucalypts are, however, less than 150 feet high, and in the inland districts a tree of 100 feet is accounted a large one. Eucalypts as a rule are not umbrageous; the leaves in many species are, by a twist of the petiole, arranged vertically and offer little obstruction to the passage of light—a character which has given rise to the charge of shadelessness. In the coastal districts and tablelands, where the soil is rich and there is plenty of moisture, shelter, and warmth, the tree-eucalypts grow tall and straight, with a clear trunk and a short leafy canopy.

No satisfactory classification of the genus has yet been devised. Leaves, anthers, bark, have all in succession been taken to provide distinguishing standards, and all have been abandoned; the latest attempt is that of Baker and Smith, who use the quantity and composition of the essential oils for a discriminating feature. Classification by the bark, however, which was originated by Baron von Mueller (q.v.) for the tree-group, is the simplest so far suggested, and serves well enough for popular use. This provides five divisions—ironbarks, stringy-barks, woollybutts, bloodwoods (scaly-barks), and gums proper (smooth-barks).

Ironbarks have a hard, corrugated bark, ranging in colour from gray to black. The Broad-leaved Ironbark (*E. siderophloia*), a coarse-leaved species, grows plentifully along the northern coastal rivers of New South Wales; the White or Gray Ironbark (*E. paniculata*) is common in the Port Jackson district; the Narrow-leaved Ironbark (*E. crebra*), with long, pendulous leaves, is widely diffused; the Silver-leaved Ironbark (*E. melanophloia*), a somewhat straggling tree, is found chiefly in inland regions of low rainfall. The name 'ironbark' is also popularly applied to a few species whose barks differ more or less from the typical form.

Stringy-barks have thick, loose, and fibrous bark with the fibres laid longitudinally. Representative species are the Yellow Stringy-bark (*E. Muelleriana*), the Messmate (a name given in Victoria to *E. obliqua*, in parts of New South Wales to *E. amygdalina*), found chiefly on the tablelands, the Red Mahogany (*E. resinifera*), a denizen of the brushes of northern New South Wales, and the common Stringy-bark (*E. macrorrhyncha*) of the dry interior foothills.

Woollybutts include blackbutts, peppermints, and boxes, whose bark has a matted or felted fibre, not as coarse as that of the stringy-barks and comparatively smooth externally. Prominent among these are the coastal Blackbutt (*E. pilularis*); the Peppermints (*E. amygdalina, E. piperita, E. radiata, E. dives,* etc.); the New England Blackbutt (*E. Andrewsii*); the Argyle Apple (*E. cinerea*); and the Cut Tail (*E. fastigata*). Several boxes also come under this

group. *E. melliodora* is the common Yellow Box of the Riverina, the tablelands, and their western slopes; it is named from the colour of its inner bark. The Bimble or Shiny-leaved Box (*E. populifolia*) and the Coolabah (*E. microtheca*) are both found on the inland plains. The Swamp Mahogany (*E. robusta*), Bangalay (*E. botryoides*) and *E. Planchoniana*, (a large-fruited tree, confined to the northern rivers and the tablelands of New South Wales) are all coastal species with woolly barks.

(a)

(b)

Eucalyptus corymbosa, showing (a) bud with operculum, (b) flower.

Bloodwoods have a scaly bark, and frequently exude a reddish kino that gives the trees a blood-stained appearance. *E. terminalis* is an interior but chiefly tropical species, and *E. corymbosa* frequents the coastal sandstone. The bark of the Yellow Bloodwood (*E. eximia*) has a decidedly yellowish cast. The White Bloodwood (*E. trachyphloia*) and the Carbeen (*E. tessellaris*) are found in the north-western areas of New South Wales; the latter derives its specific name from its bark, which on the lower part of the trunk is blackish and arranged in cubes resembling those used to make a mosaic. Bloodwoods are usually found in poor soils.

Of the smooth-barked *Gums* the Spotted Gum (*E. maculata*), with its blotched trunk, is closely related to the bloodwoods, but lacks their distinctive scaly bark. The bark of gums is usually pale in colour—from whitish to bluish-gray or green—a small portion near the butt being often hard and either scaly or fibrous. The Gray Gums (*E. punctata* and *E. propinqua*) have a blotched bark, the gray part of which is rough, thus giving the trees a distinctive appearance. The White Gums (*E. haemastoma* and *E. micrantha*) are found on the eastern coast and tablelands; the Cabbage Gum (*E. coriacea*) and Sally (*E. stellulata*), the former with a white and the latter with a green or lead-coloured stem, are both cold country species. The Gum-top (*E. Smithii*), a tall tree of the southern tablelands, yields a rich oil. (*E. saligna*), the Blue Gum of the Port Jackson district, has a red timber which distinguishes it from other species known as blue gums. The Brown Gum (*E. Deanei*) is an umbrageous species, occurring chiefly on the northern tablelands of New South Wales. The Forest Red Gum (*E. tereticornis*) usually grows in dry situations, and in one or other of its numerous forms has an extensive range. The Tasmanian Blue Gum (*E. globulus*), which yields the well-known pharmaceutical oil, is found in Tasmania, Victoria, and southern New South Wales; it has been grown in malarial districts in Europe (especially in Italy) with considerable success, and has been successfully acclimatized in California. *E. rostrata* (Red or River Gum) is probably the most widely diffused member of the genus, and the most gregarious. It extends from Western Australia to Queensland, following the courses of the inland rivers and water-channels, and is the principal tree in the Murray red gum forest area; its kino is very well known to medical men, and appears in the British pharmacopoeia as an astringent for use in cases of diarrhoea, dysentery, and relaxed throat—though the kino of *E. calophylla*, a bloodwood from Western Australia, is said to be preferable.

Mallee, a term formerly used to denote shrubby eucalypts with a thickened rootstock from which rose a series of stems of equal size, now includes all low-growing species with or without the thickened bole. The species possessing this feature are for the most part found in western

New South Wales, northern Victoria, and parts of South Australia; many of them are more or less gregarious. Among the best-known are *E. uncinata*, *E. oleosa*, *E. calycogona*, *E. gracilis*, *E. incrassata*, and *E. dumosa*, the last-named being the mallee that forms that great 'scrub' of northern Victoria. The foliage of several species gives off by distillation a strong essential oil; that of *E. incrassata* is the most plentiful (112 oz. from 1000 lb. of leaves), that of *E. oleosa* the best solvent for amber, indiarubber, etc. Typical dwarf species with a normal root-stock occur in sub-alpine areas where the soil is poor and the climatic conditions are harsh. None of the mallees attain a size from which a commercial timber may be obtained.

Eucalypt *timbers* are classed as 'hardwood,' as opposed to the 'softwood' timbers of commerce. In the best kinds—e.g. the Gray Ironbark (*E. paniculata*)—the fibres are interlocked and the timber is heavy and dense, very durable and of great strength. They may be deep red in colour, as in the Red Ironbark (*E. siderophloia*), Red Box (*E. polyanthemos*), and Red Gum (*E. rostrata*); some are brownish, as in the Blue Box (*E. Baueriana*) and Gray Box (*E. hemiphloia*). In the dry districts of the eastern part of Western Australia the timber is nearly always cigar-brown. Species with a pale timber are the Blackbutt (*E. pilularis*) and Mountain Ash (*E. gigantea* and *Sieberiana*). Ironbarks and most gums have interlocked or non-fissile timber; that of the stringy-barks is usually fissile. Among the most important commercial timbers is the Jarrah (*E. marginata*), a Western Australian species and a great asset to that State. The timber is exceptionally durable and resistant to weather, and very valuable for building purposes; it is also useful for piles and other marine work, as it resists the teredo. The Karri (*E. diversicolor*) has a timber like that of the jarrah, but heavier and less easily worked, and is much in demand for bridge-building, wherever it need not come in contact with the ground. Like the jarrah it is a gregarious species, and confined to Western Australia. Another valuable Western Australian timber tree is the Tuart (*E. gomphocephala*) with a pale yellowish wood remarkable for hardness and strength, which has the valuable quality of shrinking very little in seasoning. The Mountain Ash of Victoria (*E. regnans*) has an exceptionally fissile timber, which does not twist when drying. It is very straight in the grain, easy to work, and particularly adapted for shingles, palings, etc., as it may be split until it is almost as thin as paper. The largest trees of this species, found in Gippsland, are inferior in size only to the giant redwoods (*Sequoia*) of California. The Tallow-wood (*E. microcorys*) has a strong timber, very durable either above or below ground. It is largely used for flooring and, owing to its greasy nature, is especially selected for ballrooms. It is an eastern species, occurring chiefly in New South Wales and Queensland. The Blue Gum of the Port Jackson district (*E. saligna*) has a useful reddish timber, remarkably uniform in texture, and singularly free from the twisted character frequently found in the genus. The timber of the River Gum (*E. rostrata*) is highly valued for strength and durability, especially for piles and posts in damp ground. It is used also for shipbuilding, railway sleepers, bridges, and wharves.

See von Mueller's *Eucalyptographia;* Bentham's *Flora Australiensis;* Woolls's *Contribution to the Flora of Australia;* Howitt's *Eucalypts of Gippsland;* papers by Deane and Maiden in the *Proceedings* of the Linnean Society of New South Wales; Maiden's *Forest Flora of New South Wales, Useful Plants of Australia,* and *Critical Revision of the Genus Eucalyptus;* Baker and Smith's *Research on the Eucalypts and Their Essential Oils* (2nd edn., 1920); and Grimwade's *Anthography of the Eucalypts.*

Eucalyptus Oils. It was the exudation from eucalypts, rather than their essential oils, that first attracted the attention of European visitors to Australia; Dampier, Banks, and Phillip all mentioned the 'red gum' as characteristic of the new kind of tree. But the Banks papers show that in November 1789 Sir Joseph received from Phillip a bottle of eucalyptus oil; and in 1790 John White, Phillip's surgeon-general, stated in his published *Journal* that an essential oil extracted from eucalypt leaves had been used by him with considerable success in treating 'cholicky' complaints, and that he had forwarded a quart of the oil to 'a Mr. Wilson' in England. This oil, therefore, was probably the first natural product of Australia to be exported to England. It was most probably distilled from the tree known as the Sydney Peppermint (*E. piperita*), which is still common round Sydney. Little more, however, was done in the direction of exploiting the oil until von Mueller in 1853 recommended the distillation of eucalyptus oil as an industry, and in the following year the first factory for its commercial production was established in Victoria by J. Bosisto. At that time the various constituents of the oils were undetermined and their comparative values unknown, so that the yield of oil became the chief guide when choosing species for distillation; as some members of the peppermint group yield oil in the greatest quantity, they were naturally employed for the purpose. The yield is still of considerable importance in the industry. It varies greatly, although it is fairly constant for each species; in the case of the most prolific eucalypts 30 to 40 lb. of oil can be distilled from 1000 lb. of green leaves and terminal branchlets, but some species yield less than 1 lb. of oil from the same bulk of leaves. Species with the lower yields are consequently neglected unless the oil constituents are of exceptional value—e.g. *Eucalyptus Macarthuri* of New South Wales and *E. citriodora* of Queensland. *E. Macarthuri* gives an oil rich in the valuable alcohol geraniol and its ester geranyl-acetate and the oil of the Queensland tree consists largely of the aldehyde citronellal.

Serious study of the constituents of these oils dates from 1870, when the oil of *E. globulus* was investigated by Cloëz in France; he named its chief constituent eucalyptol, but this was shown later (by E. Jahns) to be identical with cineol. Since that time the constituents occurring in the oils of 180 species of *Eucalyptus,* have been determined, and no less than 40 distinct chemical substances have been isolated and characterized from the several oils. For pharmaceutical purposes the chief constituent demanded is cineol (eucalyptol) and to satisfy requirements in this direction only those species are utilized which both for yield of oil and for cineol content give the best return. Such species are *E. polybractea, E. Smithii, E. Australiana, E. cneorifolia*; a few others are employed in restricted localities by certain distillers. The proportion of cineol in the oil required by the American pharmacopoeia is 70 per cent, and by the British 55 per cent. The American require-

ment is not easy to satisfy as very few species yield oils of this character, but the more moderate British standard can be met with oils of numerous species. If desired, pure cineol may be employed instead of the oil, as this constituent can be readily frozen out, and then by mechanical treatment removed from the terpenes and other bodies which cannot be frozen.

In 1910 Henry Lavers at Broken Hill in New South Wales, discovered the fact that a small quantity of certain eucalyptus oils when added to finely ground minerals, had the property of separating the metallic sulphides from the gangue by a flotation process. The oils most suitable for this purpose are those consisting largely of the terpene phellandrene and the ketone piperitone, and are distilled from *E. dives* and *E. phellandra*. The yields from these species are good, and, as they are plentifully distributed in both New South Wales and Victoria, an abundance of oil can be cheaply prepared for flotation purposes. Eucalyptus oils are also utilized in other directions—in the manufacture of numerous proprietary articles, for soap-making, for disinfectants, and as solvents. They also offer opportunities for scientific research, and products of considerable economic value have been manufactured from certain of their constituents.

Eucalyptus oils are readily procured from the leaves by a simple process of steam distillation, numerous types of stills being employed. The simplest consists of an ordinary cubic 400-gallon iron tank, fitted so as to prevent the escape of steam except through the pipe leading to the condenser. This tank-still, containing the leaf material and about eight inches of water, is placed on a suitable platform and a fire lighted beneath. Condensation of the escaping steam (which conveys the oil) is accomplished by passing it through a worm placed in a separate vessel filled with water, or by running the outlet-pipe sufficiently far along a running stream to secure complete condensation. In the receiver the oil and water separate, the oil floating on the top of the water, so that it may be readily removed. Larger types of still require a boiler for the production of the steam; in these the digesters are often of considerable size, and are frequently sunk in the ground. In Victoria these large digesters are usually constructed of wood, but in New South Wales iron digesters are employed. The crude oils first distilled are seldom of sufficient purity to satisfy commercial requirements, and must undergo a process of rectification, which is not often undertaken by the primary distiller.

The economic value of the industry cannot be accurately ascertained, but besides the oil utilized in Australia large quantities are exported to Britain and the United States, the export value growing from £60,000 in 1916-17 to £107,000 in 1920-21. In 1922, however, only £24,000 worth was exported. H.G.S.

Eucalyptus oils may be used as disinfectants in several ways either mixed with lard, paraffin, or other neutral oil, or with water as a general disinfectant. The watery mixture may be employed as a spray, or the oil itself may be scattered over the floor with the expectation that it evaporates and disinfects the atmosphere; when mixed with oil, its disinfecting power is very feeble—much less effective than that of phenol or carbolic acid. Ointments containing eucalyptus oil act as cutaneous stimulants rather than as disinfectants. The older oils are more efficacious than fresh or recently distilled oils, as they contain more acid. During storage this acid is developed, and reacts upon the oil, giving rise to products that are more active. The most acid oils, however, when made into ointments are never so good as carbolic oil.

The vapours of the oils have a good disinfecting action, but they must be used in conjunction with water vapour, or (what comes to the same thing) the infected material exposed to the vapour should be moist. For example, if an influenza mask were put into a closed box whose walls and bottom were sprinkled with the oil, disinfection would depend upon whether or not the mask had been wetted when put in. A damp mask would be sterile in an hour at summer temperature, but a dry mask would require three days.

As a spray for rooms, an emulsion of one part of the oil in three hundred parts of water would be as effective as a solution of one part of phenol (carbolic acid) in one hundred parts of water. The eucalyptus oil, too is the cheaper and less dangerous. Such an emulsion destroys ordinary bacteria in half an hour. The efficiency of the oil is increased by adding acid to the water employed in preparing the emulsion. An ounce of vinegar added to a gallon of the water would double the activity of the oil.

The pure oil formerly known as eucalyptol, but now as cineol, is from 3 to 3½ times more active than phenol when tested by giving the disinfectants half an hour to act upon *Bacillus coli communis* at 20° C. (68°F.). This is the most effective exposure; the efficiency of the pure oil is lower with shorter or longer times. It may be said to be a slow disinfectant. Phenol exerts its maximum effect in about a 20th of the time; that is to say, the germicidal activity of phenol begins to slow down in a minute and a half, that of cineol in 30 minutes. If time is an object, phenol is preferable to cineol; but if, as in many cases, the infected material can lie in the disinfectant for an hour or more, cineol is indicated. The two disinfectants have the same efficiency in five minutes at 20° C. in dilutions of 1 to 75.

The ordinary eucalyptus oils are mixtures of cineol with other constituents. Their disinfecting powers vary, much depending upon their age. The rectified oil of *E. cinerea* after some years' storage was six times as active as phenol, while recently distilled specimens were from 2½ to 3 times as effective. The variety of *E. australiana* that grows on the ridge of the Dividing Range furnishes one of the most effective oils. Its phenol number is six, it contains phellandrene, and can only be used for disinfecting purposes. The rectified oils of *E. Smithii* and *E. australiana* (1st hour oil) are medicinal oils and good disinfectants, with phenol numbers ranging from 3½ to 4; indeed most of the oil numbers are above three, probably because they contain a majority of constituents that have thrice the efficiency of phenol. Aldehydes are the most powerful of the minor constituents. Oils containing much pinene or sesquiterpene are likely to be poor disinfectants; those tested were found to be weaker than phenol. R.G.S.

Eugenia, a genus of the family Myrtaceae, consisting of trees or shrubs chiefly tropical or subtropical. The calyx-tube is almost globular, the lobes short or prominent; petals 4, rarely 5; stamens numerous, free or collected in 4 bundles; fruit a berry or drupe, or almost dry and with a fibrous coat; leaves opposite. *E.*

Smithii (Lilly-pilly) has a profusion of white fruits with a purplish tint, which are eaten by aborigines and small boys and are acidulous and wholesome. The fruit of *E. myrtifolia* (Brush Cherry) makes a good preserve, and its red juice, when fermented, yields a wine with a bouquet. *E. Jambolana* (Durobbi of the abor-

Lilly-pilly.

igines) has a fruit resembling a plum, with an astringent but sweetish flavour. The fruit of *E. Ticrneyana* is produced in large quantities, and is used for making jam by the settlers round Rockingham Bay. *E. Ventenatii* (Drooping Myrtle), a tree of charming habit, has beautifully marked timber of a greyish hue, close-grained, hard, heavy, and tough. It is used for poles of drays, ribs of boats, and flooring boards of verandahs. *E. suborbicularis* has wood with peculiar concentric rings several inches apart. Out of the trunk of this tree the Johnstone River (Queensland) natives make their canoes.

Euphorbia, a large and widely distributed genus of the family Euphorbiaceae, consisting of herbs or shrubs which have a milky, acid juice. The 30 species indigenous to Australia range right across the continent. *E. Drummondii* (Caustic Weed) is a succulent, prostrate herb abundant in the drier regions. It is eaten greedily by stock, and is wrongly reputed to be poisonous. The aborigines use an infusion of the plant medicinally, and are said to use the juice for attaching small feathers to native bees, so that they may be followed to their nests to obtain the honey. *E. pilulifera* (Asthma Herb) has acquired a reputation in pulmonary complaints, and is still sold by herbalists. Though indigenous, it is a common tropical weed.

Euphorbiaceae, a very large family consisting of trees, shrubs, or herbs which frequently contain a milky juice; most abundant within the tropics, rarer in colder climates. More than 40 genera with 276 species are indigenous to Australia. *Breynia* has four indigenous species, ranging from New South Wales to northern Australia. *B. oblongifolia* is an ornamental shrub, with a blackberry-like fruit and a straw-coloured wood; the leaves turn black when dried. *Bertya,* a genus ranging from Western Australia to Queensland, has 15 indigenous species. The branchlets of *B. Cunninghamii* exude a clear gum resin, which gives a hyaline appearance to dried specimens when held up to the light. The resin is yellow, and has a pleasant, bitter taste, something like wormwood. *Bridelia,* a warm-country genus, has four indigenous species, which extend from northern New South Wales to northern Australia. *B. exaltata* (a tree of 90-100 feet) is the 'biggera-biggera' of the northern New South Wales aborigines. It has a brown, hard timber somewhat resembling walnut. *B. faginea,* a tall shrub with ornamental red berries, also has a useful timber. *Dissilaria* is a genus with three indigenous species, extending from Queensland to northern Australia. *D. baloghioides* is a 'teak,' with a hard, durable timber, brown in colour but darkening towards the centre. It resembles the wood of the English apple, and might be used for similar purposes. The aborigines call it 'currungul.' The genus *Hemicyclia* has three indigenous species, ranging from New South Wales to northern Australia. *H. australis* is an ornamental tree of 40 feet, bearing succulent, bright red, oval fruits. It has a hard, close-grained timber, yellowish when fresh. See ALEURITES, ANTIDESMA, BALOGHIA, BEYERIA, CROTON, EUPHORBIA, EXCAECARIA, HOMALANTHUS, MALLOTUS, PETALOSTIGMA, PHYLLANTHUS, RICINOCARPUS.

Eureka Stockade, THE. To meet the expense of securing order on the Victorian goldfields, and to restrain unauthorized mining on waste crown land, a local act of January 1852 imposed on all diggers a licence fee of 30 shillings per month, the penalty for mining without a licence being £5 for the first offence and afterwards imprisonment for terms up to 6 months. Clause 7 of this act appropriated half the recovered penalties to the use of the informer or prosecutor—a provocative and irritating provision. In December 1853 an amending act reduced the fee to £1 per month, but did not alter the diggers' great grievance—that they could be imprisoned for not having the actual licence on them, though their possession of one could be proved from the official record. They were, too, unrepresented in parliament, though in 1854 the population on the Ballarat goldfields was estimated at 20,000.

Sir Charles Hotham (q.v.), who reached Victoria in June 1854, was alarmed at the depleted state of the treasury and the growing expense of goldfields administration, and ordered the police to redouble their exertions in collecting the fees. To miners barely making rations the payment of £12 per annum was impossible, and doubtless hundreds did endeavour to evade payment, but the innocent suffered with the guilty. The police, too, had been largely recruited from Tasmania, and many were ex-convicts who had risen to be gaol-warders; some, in addition to their venality, showed a rough brutality. These grievances were common to all the Victorian fields, and had under Latrobe's administration produced riots at Beechworth and Castlemaine. Bendigo was the malcontents' headquarters, and in the first months of Hotham's regime even

Bendigo became orderly. Ballarat had always been the most domestic of the goldfields, renowned for its schools and for its quietness on Sundays. But on the night of 6 October a miner named James Scobie was killed at the Eureka Hotel near Ballarat, and the murdered man's brother accused the proprietor (Bentley, a Tasmanian ex-convict) of the murder. Bentley was brought up before a magistrate, and discharged. The miners were indignant; a meeting was called for the 17th, and a committee appointed to demand a fresh prosecution. The meeting itself was orderly, but towards the end of it a cry was raised that the police (who had been ordered to protect the hotel) were trying to disperse the meeting, and the miners, becoming furious, swept aside the police, smashed the windows and furniture, and burned the building. The police arrested three men, who could not be proved to have been ringleaders or active in the riot, but were sentenced to three, four, and six months' imprisonment. At an indignation meeting held on 11 November on Bakery Hill the Ballarat Reform League was formed, with J. B. Humffray (a Welshman) as its first secretary, and Peter Lalor (q.v.), Frederic Vern (a Hanoverian and a talker), Raffaello (an Italian teacher of languages), Timothy Hayes (an Irishman) and George Black (an Englishman of good education and considerable intelligence) as prominent members. A deputation of three men waited on Hotham to demand the release of the prisoners, but he had already sent additional troops to Ballarat, and on the 27th refused the demand. Meanwhile the troops, arrived in Ballarat, had given considerable offence by marching in with fixed bayonets; their captain's refusal to parley with 'rebels' fired the crowd, which threw itself on the convoy, overturned a waggon, captured another, and injured three or four soldiers. This action, it should be remembered, was condemned by the leaders of the League. On 29 November Black, Humffray and Kennedy reported to a mass meeting held at Bakery Hill the result of their deputation, and pleaded for further negotiation. Lalor carried a proposal to elect a central committee, Vern proposed a burning of the obnoxious licences and the meeting pledged itself to burn all licences and to unite and protect anyone arrested for having none. Bonfires were lighted, and the licences burnt there and then. Next day (30 November) the police were ordered to make a specially vigorous licence-hunt; a squadron of mounted troopers was received with volleys of stones and an occasional pistol-shot; Commissioner Rede endeavoured to read the riot act, but was told the licences were all burned and that, if he liked, the whole camp would surrender—an obviously absurd proposal, as it would have been impossible to guard so many prisoners. When the troops marched back to camp, the diggers hastened to a conference with the leading spirits of the League. Peter Lalor was elected leader, and under a blue flag adorned with the stars of the Southern Cross, which had already been flown at the meeting of the 29th, the assembled diggers swore 'to stand truly by each other, and fight to defend our rights and liberties.' An area of about an acre on the Eureka claim was hastily enclosed with piled-up mining slabs, building timber, and any other material handy. A deputation sent to the camp demanded the release of the morning's prisoners and the cessation of licence-hunting, but the commissioner refused flatly, saying that the agitation was only a cloak to cover a democratic revolution.

On 1 December the occupants of the stockade were hard at work by 5 a.m. drilling, and improving the barrier, and a German blacksmith was fashioning pike-heads. But neither food nor ammunition was available within the stockade, and many men left it in search of these commodities, so that by the evening of the 2nd not more than 200 remained within. Spies informed the commissioner of the situation, and about 4.30 a.m. on Sunday morning (3 December) a troop of 276 men was marched silently to the stockade. Of those within about 50 had rifles; there was also a troop of Californian diggers armed with revolvers and another of Irishmen with pikes; many of them were asleep when the signal gun was fired and a storming party of 64 'rushed' the stockade. In the first volleys several men fell on both sides, but the line of advancing bayonets, flanked on both sides by cavalry and mounted police, was too much for the diggers. They turned to seek shelter, and all was over. Of the military force Captain Wise and four private soldiers were killed, and about a dozen injured. Sixteen miners were killed, and at least eight others died of their wounds—probably many died in hiding; 114 prisoners were taken, but all were discharged except 13 (including Hayes and Raffaello) who were held to take their trial for high treason. Lalor, badly wounded, managed to escape: so did Black and Vern, though the government offered £500 for the apprehension of Vern, and £200 each for Black and Lalor. Ballarat was put under martial law at once. On the 5th Sir Robert Nickle (q.v.) arrived with reinforcements. He blamed the rebels, but listened to the miners' grievances, and his just and conciliatory treatment had a soothing effect on the population—as did his announcement that the governor had appointed a commission to enquire into their wrongs. On the 9th the ban of martial law was withdrawn, though the miners declared they preferred it to police rule.

The trials began in February 1855 and two men were acquitted without needing to defend themselves. The attorney-general postponed the rest of the trials until March, but without effect —all the men appeared, pleaded, listened to the charges, and were also acquitted without being called on for a defence. When the last prisoner walked free, the rewards for the capture of the missing men were withdrawn. While the diggers' grievances were undoubtedly great, and the severity of the police administration was officially condemned by a royal commission appointed by Hotham to enquire into the whole trouble, it is also certain that some of the League's leaders had in view far more than a mere redress of grievances. Lalor, Humffray, and Black were probably inspired solely by indignation, but several of the Italian, German and American leaders hoped to make the movement a political one, and to establish a republic.

See H. G. Turner's *Our Own Little Rebellion*, and Withers's *History of Ballarat* (1870: 2nd edn. 1887). Ross's *Eureka* (Melbourne, 1914) summarizes the rebellion from the rebels' standpoint; it admits that 'the authenticity and accuracy' of Turner's facts are 'unchallengeable,' but controverts his opinions and deductions.

Evans, George Essex (1863-1909), born in London on 18 June 1863 and educated at Haverford West and in Guernsey, migrated to Australia in 1881 to gain bush experience, and a little later joined his brother J. B. O. Evans

in farming land near Allora in Queensland. He soon found, however, that his real bent was for literature, and became a contributor to the *Queenslander*, the *Brisbane Courier*, and the Sydney *Bulletin*. In 1888 the Queensland government made him district registrar at Toowoomba, and in later years employed him to write up the State for immigration and exhibition purposes. In 1891 Evans published in London his first book of verses, *The Repentance of Magdalene Despar*; pursuing thereafter his own aims, he to a great extent wasted his powers on trivial and uncongenial subjects, and injured himself by attempting to become a publisher as well as an author. His editorship of *The Antipodean* (an annual published in 1892, 1893, and 1897) was a failure, and only with the winning of the official prize for an ode on the inauguration of the Commonwealth did he attain fame outside Queensland. His *Loraine*, a long narrative poem dealing with life on a sheep-run published in Melbourne in 1898, afterwards attracted attention in London, where he was reckoned one of the half-dozen outstanding Australian poets. He was in fact a cultured craftsman with a poetic turn of mind; the best of his work (including a good deal of the *Loraine* volume) is contained in *The Secret Key*, published at Sydney in 1906. He died at Toowoomba on 10 November 1909.

Evans, George William (1778-1852), born at Warwick in England and apprenticed while still a boy to a surveyor and architect, left home in or about 1796 to go to the Cape of Good Hope, and secured a good post in the government dockyard there. When in 1802 the Cape was handed back to the Dutch, Evans was picked up by H.M.S. *Buffalo* on her way to Australia and reached Sydney on 16 October, with, it is said, a commission as deputy-surveyor in his pocket. This was not at first of much use to him; the best King could do for him was to make him (on 2 November) storekeeper at Parramatta and give him a 90-acre farm. On 10 August 1803, however, Grimes the surveyor-general having gone home on leave, Evans was appointed his locum tenens. In March 1804 he was sergeant-major of the Parramatta volunteer company, but by August had been promoted to lieutenant. In July of that year he was one of the officers charged with taking a general muster of settlers, and entered his own land as 539 acres, 30 being laid down as orchard. A brief entry in a schedule of Governor King's states that on 22 February 1805 he was 'discharged for Fraud,' but no details of this affair are known. He then settled at the Hawkesbury, and was one of the pro-Bligh party there in 1807; in spite of this Paterson during 1809 made him assistant-surveyor at Port Dalrymple, and Macquarie in 1810 confirmed the appointment, but for three years his work was done in New South Wales, and it was only in September 1812 that he actually took up the Tasmanian appointment, proceeding to Port Dalrymple in the *Lady Nelson* with James Meehan (q.v.). After a few months he was recalled, and sent in November 1813 to confirm and extend the discoveries of Gregory Blaxland's party in the Blue Mountains; his work on this journey, and on all those referred to later, is narrated under Exploration by Land. Macquarie approved it so highly that he sent Evans back to Tasmania in May 1814 with an order for 1000 acres to be selected on the Derwent (exclusive of 300 acres which had been given him on his first trip), the services of four convicts, a right to choose an allotment for his Hobart residence, and a supply of stock on deferred payment terms. In January 1815 the restless Macquarie recalled him once more to act as guide in the projected official tour to the Bathurst plains which he had discovered in 1813; this resulted in the discoveries of May-June, which placed the Lachlan River on the map and much delighted Macquarie's heart by opening up 'a very great Extent of Country possessed of Many and very important Advantages for a Numerous Population.' This was probably the apex of Evans's career; he had opened up land of immense value to the settlement, obtained the approbation (both expressed and confirmed by gifts) of his immediate ruler, and obtained from the English secretary of state a statement that he (Bathurst) could not 'refrain from expressing my Sense of the Exertions Perseverance' (*sic*) 'of Mr. Evans.' On reconsideration, however, Bathurst thought him not sufficiently educated to report usefully on his discoveries, and on 18 April 1816 directed that in future he should be associated with someone 'of more scientific Observation and of more General Knowledge.' When, therefore, Macquarie in 1817 fitted out an expedition to carry still farther the exploration of the western plains, he put Oxley in command, laying stress in his report to Bathurst on Oxley's 'general and Scientific Knowledge and liberal Education;' Evans was made second in command, both as an act of justice and because his previous experience would make him very useful. In 1818 a second Oxley-Evans expedition made still more important discoveries; Oxley on his return handsomely acknowledged the help Evans had given him, and Macquarie, when asking permission to recompense Oxley with a lump sum, suggested that Evans should receive at least half as much as might be given his superior. Bathurst agreed, and, as Oxley was given £200, Evans received £100.

From 1818 onwards Evans was employed on his Tasmanian duties, which were arduous and ill-paid. His pay as deputy-surveyor-general for the settlement was 7s. 6d. per day; half his year was spent in the field, often in bivouacs, and the other half barely sufficed to bring his office work up to date. In 1821 Macquarie managed to double his salary by giving him the additional appointment of collector of quit-rents and inspector of roads and bridges. In 1825 he asked permission to retire on a pension, partly because of ill-health, partly because he had been severely—and, it would appear, unjustly—denounced by Arthur for allowing a settler too much land (Evans proved that he had done this under direct instructions from Sorell, the previous governor). At the critical moment Darling arrived, on his way from England to take up the governorship of New South Wales; Arthur put his case, and Darling welcomed the opportunity of providing a billet for his brother-in-law Edward Dumaresq (see Dumaresq, Henry); Evans was therefore retired on a pension of £200 a year, just when Bathurst—knowing nothing of events in Tasmania—had made him surveyor-general of the new colony. On 16 November 1826 he sailed for England. But he had been too long in Australia to find England restful. In 1832 he returned to Sydney and opened a circulating library and stationer's shop in Bridge-street; in the *New South Wales Calendar* for 1833 he and

three others (Ralph Mansfield, q.v., among them) appear as 'booksellers,' the first who used that name in Australia. When in 1834 Mansfield transferred his stock and goodwill to Evans, the ex-surveyor became the doyen of the trade, and is often thought to have been actually its pioneer. Mrs. Evans meanwhile had established a girls' school at first on Miller's Point, afterwards in Castlereagh-street. In 1842 the family went back to Hobart, and there Evans died on 16 October 1852.

His chief work for Australia was his series of discoveries, but Bathurst was undoubtedly right in suggesting that he was not fully equipped for exploiting them. His maps are frequently inaccurate, even for an explorer's. In his survey of Tasmania he avowedly depended mainly on the careful work of his assistants. And, though his personal integrity seems unassailable, he was on occasion more pliant to the wishes of his superiors—especially to Sorell's—than was fitting in the holder of so responsible a position. This pliancy accounts for the questionable transactions which Arthur denounced—and may have had something to do with the unexplained dismissal by King. Against it we must place the approval of Macquarie, no easy master, who throughout his term of rule took unmistakable pleasure in setting forth Evans's services to the colony, and in asking that they should be suitably rewarded.

Everlastings. See HELICHRYSUM and HELIPTERUM.

Ewing, SIR THOMAS THOMSON (1856-1920), born at Pitt Town on the Hawkesbury River on 9 October 1856, was in his early life a licensed surveyor, but in 1885 entered politics as member for the Richmond (1885-94), and later for Lismore (1894-1901), in the New South Wales assembly. Lacking the purely partisan qualities and possessed of overmuch humour for a politician, he yet did good work as chairman of the works committee and of a royal commission on railway extension within the city of Sydney. Representing a constituency on the border of Queensland—to which colony it had always desired affiliation—he was from the first an ardent and effective federationist, and left State politics in 1901 to become member for the Richmond in the federal parliament. Here he attached himself to Alfred Deakin, and in the Deakin ministry of 1905-8 was, first, vice-president of the executive council and then (from 24 January 1907) minister for defence. In the latter capacity he strongly advocated compulsory training of young citizens for military and naval service, and introduced a bill to effect this. In 1910 he retired from politics, devoted himself to the management of his lands on the Tweed River, and died in Sydney on 15 September 1920.

Excaecaria, a widespread tropical genus of the family Euphorbiaceae, with three species indigenous to Australia, which range from New South Wales into northern Australia. *E. Agallocha* (Milky Mangrove or River Poison tree) exudes, when an incision is made in the bark, an acrid, milky juice, so volatile that no one can gather a quarter of a pint without being affected by it. The symptoms are a burning sensation in the throat, sore eyes, and headache. A single drop falling into the eyes is said to cause blindness. The natives of eastern Australia, as well as those of New Guinea, use this poisonous juice to cure leprosy, but in Fiji the patient is fumigated with the smoke of the burning wood. In India the sap of the tree is called 'tiger's milk,' and is applied with good effect to inveterate ulcers. A good caoutchouc may also be prepared from the milk. The tree has a light, soft wood, which would answer for carving and marqueteric. *E. Dallachyana* and *E. parvifolia* also have useful timbers.

Exclusionists. See EMANCIPISTS.

Exhibitions. *New South Wales.*—A show of exhibits from New South Wales for the Paris exhibition of 1855 was opened by Sir Charles Fitzroy in the large hall of the Australian museum on 14 November 1854, and closed on 9 December. In 1861 a display of exhibits for the London International Exhibition of 1862 was opened on 16 October in the lecture hall of the Sydney school of arts and closed on 7 November. Stuffed alpacas (q.v.) and llamas were among the exhibits, to show that these animals could be successfully reared in Australia. In 1870, to celebrate the centenary of Captain Cook's landing in Australia, an intercolonial exhibition was opened on 30 August in the exhibition building at Prince Alfred Park; it was closed on 30 September. A second intercolonial exhibition was opened in Sydney on 3 April 1873, and a third on 6 April 1875. On 17 September 1879 was opened the first international exhibition held in Australia, the 'Garden Palace' being specially erected for the occasion in the inner domain; it closed on 20 April 1880. The building, with many exhibits that had been left in it, was totally destroyed by fire on 22 August 1882. On 24 January 1888 an intercolonial agricultural exhibition, promoted by the Agricultural Society with the assistance of the government, was opened in connection with the centenary celebrations. A number of smaller and more specialized exhibitions were subsequently held in Sydney; among these mention may be made of the all-Australian exhibition of manufactures, products, arts, and industries, which was held from 7 October to 18 November 1922.

In *Victoria* an exhibition of the products to be sent to the Paris exhibition of 1855 was opened on 17 October 1854, and closed on 12 December. In 1861 the exhibits for the International Exhibition of 1862 were on show in Melbourne from 1 October to 7 December. The first intercolonial exhibition in Victoria was opened on 24 October 1866 in an exhibition building erected in connection with the Melbourne public library; it closed on 23 February 1867. New Caledonia, Mauritius, and the Dutch Indies were represented at this exhibition. The Victorian products to be shown at the London International Exhibition of 1873 were on show in Melbourne from 6 November 1872 to 18 January 1873. On 2 September 1875 an intercolonial exhibition was opened, preparatory to the sending of exhibits to the Philadelphia Centennial Exhibition of 1876. On 1 October 1880 the first international exhibition held in Melbourne was opened in permanent buildings erected for the purpose in Carlton Gardens; it closed on 30 April 1881. The buildings still stand, and are in part used to house the Victorian legislature. In 1888 a Centennial International Exhibition was held in connection with festivities arranged to commemorate the first British settlement in Australia; it was opened on 1 August, and closed on 31 January 1889. The Bendigo Exhibition, held to commemorate the jubilee of the gold discoveries, was open from 13 November 1901 to 14 May 1902. On 23 October 1907 was opened the first international exhibition of women's

work; it closed on 3 November. The first all-Australian exhibition promoted by the Australian chamber of manufactures was open in Melbourne from 13 September to 8 November 1913.

The first exhibition in *Queensland* was opened in Brisbane on 29 October 1861. An intercolonial exhibition promoted by the National Agricultural and Industrial Association was held at Bowen Park, Brisbane, from 20 to 28 August 1876. The first international exhibition in Queensland was organized to commemorate the Queen's jubilee in 1897; it was opened at Bowen Park on 5 May, and closed on 14 August. The first international exhibition in *South Australia* was arranged by Messrs. Joubert and Twopeny at the close of the successful Melbourne exhibition of 1880-1; it was opened in Adelaide on 21 July, and closed on 24 September. In 1887 a second international exhibition was held to commemorate the jubilee both of Queen Victoria and of the founding of the colony; it was opened on 20 June, and closed on 17 January 1888. An exhibition was held in *Western Australia* from 21 November to 31 December 1881. The first international exhibition held in *Tasmania* was opened at Launceston on 25 November 1891, and closed on 22 March 1892. The international exhibition at Hobart was held from 15 November 1894 to 25 May 1895. On 1 January 1913 an inter-State exhibition, to show the progress of Australia since the inauguration of the Commonwealth, was opened at Launceston under the auspices of the Australian Natives' Association.

Exploration, French. The fact that the whole continent of Australia has been colonized and is now possessed by people of British origin, is due mainly to the maritime supremacy of Great Britain, won after half a century of conflict with the French nation, which existed during the critical years (1810-1840) of Australian colonization. There is no historical evidence to justify the belief that France at any time formulated plans for occupying any portion of Australia. But there is an abundant literature to show that, long before Australia was known to geography even in outline, as well as long after the ownership of the country was settled, the problems presented by southern regions to men of science and to explorers appealed to the intellectual alertness of the French; and voyages undertaken by them occupy a considerable part in the story of Australian discovery. Among these, however, need not be reckoned a supposed voyage of Binot Paulmier de Gonneville, for whom it has been claimed that in 1503-4 he was blown by storms away from the African coast and spent six months in 'Southern India,' which he named 'Terre Australe.' Unfortunately the story depends entirely on the authority of a self-styled 'Indian Priest' who 160 years later claimed to be the great-grandson of an aboriginal chief brought to France by de Gonneville; and, when, early in the eighteenth century, some geographers revived the claim in order to prove that Frenchmen were the first discoverers of New Holland, a French writer pointed out that the priest's account was full of impossibilities, and that, wherever de Gonneville went (if he went anywhere), he certainly did not reach New Holland.

Fourteen years before James Cook sighted eastern Australia, a French philosopher, Charles de Brosses, published in Paris two volumes in which he pleaded for a systematic investigation of the southern hemisphere by French navigators. De Brosses, as he acknowledged, had his attention directed to the subject by the *Petites Lettres* of Maupertuis, in which that savant enumerated 12 projects requiring to be pursued by men concerned with the advance of science—one of which was an exploration of the oceans that washed unknown lands in the south. De Brosses took up this thesis and expanded it; his copious volumes summarized all the information then obtainable about the region with which he dealt, narrated the explorations of Tasman and Dampier, and indicated advantages that might accrue to France from such a voyage as he desired to see undertaken. He also, by the by, devised the word Australasia (i.e. Asia of the south).

In 1766, ten years after the publication of the *Histoire des Navigations*, Louis de Bougainville, commanding the *Boudeuse* and the *Etoile*, sailed for the southern Pacific; his principal achievements there were the discovery of the Navigator Islands and the careful examination of the Solomons, but he did not touch the Australian continent. Five years later, in 1771, Nicholas Marion-Dufresne, with his own ship the *Mascurin* and the French warship *Marquis de Castries*, visited southern Tasmania and New Zealand, where he met his death at the hands of the Maoris in 1772. In the same year, according to some high authorities, a certain Captain de St. Alouarn in his vessel the *Gros Ventre* reached the coast of Western Australia. Doubt has been cast on the authenticity of this voyage; but Dr. A. Grandidier, secretary of the Institut de France, vouches for it, and in 1792 Dentrecasteaux (mentioned below) named after St. Alouarn the first Australian islands he saw.

The voyages of Bougainville and Marion-Dufresne were undertaken under the influence of the work of de Brosses. The next undoubted French voyage in Australasian waters was inspired by the discoveries of Cook. Louis XVI, a sincere admirer of the great English navigator, had read with keen interest the narrative of his voyage in the *Endeavour*, and resolved to fit out a French expedition to win similar renown for the navigators of France. He placed it under the command of Lapérouse, under whose name an account of the famous but disastrous voyage will be found. The mystery surrounding the fate of this brave explorer led to the despatch in 1791—just when the death of Mirabeau and the attempted flight of the royal family to Varennes were deciding the fate of the monarchy—of a search expedition under Bruni Dentrecasteaux, who in the *Recherche* and the *Espérance* visited Tasmania in April 1792, ran north to the Solomons and Moluccas and west through the Malay Archipelago, and then, turning south, sighted the coast of Western Australia in December a little south of the Leeuwin, and coasted it closely, charting it as he went, to Termination Island. Beautemps-Beaupré, the cartographer of the expedition, was a skilful draughtsman, and the excellence of his work was cordially acknowledged by Flinders when he went over the same ground ten years later. In Tasmanian waters, too, the work of Dentrecasteaux was geographically fruitful, but he failed to find any traces of Lapérouse. He himself died in distressful circumstances before the voyage was over, and Huon Kermadec, his second in command, also perished at sea. Both in Western Australia and in Tasmania, as a study of the map will show, the memory of this expedition, its commanders, and the vessels that composed it, has been well kept alive.

The most important of these French voyages, both on account of the work done and the historical surroundings, was that commanded by Nicholas Baudin (1800-4). The fact that his expedition, consisting of the *Géographe* and the *Naturaliste*, was despatched while Napoleon Bonaparte was first consul, has frequently led to the hasty conclusion that it was a subtle move in Napoleon's game of undermining British prestige. But the published and documentary material relative to the expedition gives no support to this suspicion. Baudin's diary, his despatches from Australia, and the confidential instructions given to him by the minister of marine, are sufficient to show that the expedition was scientific in its origin and purpose, and that its work throughout was pursued in a spirit of scientific research. Napoleon, indeed, had nothing to do with its actual promotion. The Institut de France was of opinion that valuable scientific work might be done by a well-equipped expedition, and prepared the plan which was ratified by Napoleon as head of the government. The whole coast of Australia from Port Jackson south-about as far as the Gulf of Carpentaria was investigated by Baudin, and the work of his cartographers, though not uniformly excellent, was often accurate and was very beautifully reproduced. This commendation chiefly applies to the charts of Spencer and St. Vincent gulfs and Kangaroo Island, where the work was in charge of Lieutenant Louis de Freycinet, a thoroughly skilful officer. The Tasmanian part of the work is also of exceptional merit. Baudin's ships visited Sydney in June-November 1802. The commander and his officers were on very friendly terms with King and the British garrison, who treated the French with generous hospitality. After their departure, on 18 November, a rumour came to King's ears that one of the officers had told Lieutenant-colonel Paterson that the expedition intended to annex territory in Tasmania for the French nation. King sent the *Cumberland* in pursuit; acting-Lieutenant Robbins, who was in command of her, finding the French at King Island, landed a party and ran up the British flag as a sign of possession. But Baudin in a letter to King denied that he had had any acquisitive purpose in view. Nevertheless the fear of French designs upon Australia had important consequences in regard to British occupation, since it led to the occupation of Tasmania and (temporarily) of Port Phillip in 1804. Baudin died before his expedition returned to France.

In 1817 Louis de Freycinet was sent out in command of the *Uranie* and the *Physicienne;* this expedition visited Australia, reaching Sydney in 1819, and produced an atlas of superb charts, which renewed French interest in Australia—and consequently renewed also British fears of a French occupation. In 1822 Duperrey, who had been Freycinet's second lieutenant, was despatched with the *Coquille* to make a thorough investigation of the Pacific: he visited Sydney in the early part of 1824, and his surgeon, Pierre Lesson, compiled a valuable history of the voyage. Before Duperrey reached France again, the Baron de Bougainville in 1824 sailed for the Pacific with the *Thétis* and the *Espérance*, and visited southern Tasmania. In 1826 Dumont d'Urville, one of Duperrey's lieutenants, took out the *Coquille* again, renaming her the *Astrolabe*, and in the next three years coasted Australia from King George's Sound to Port Jackson, and visited New Zealand and most of the island groups of the western Pacific and Malaysia. It is noticeable that he devoted particular attention to Western Port. No documentary history of these three voyages has yet been studied. They certainly corresponded with French movements in the direction of colonization elsewhere; and they had the immediate effect of inducing a British settlement at Western Port (1826) and at Albany in Western Australia (1829). Lord John Russell recorded many years later that, during his term as colonial secretary (1839-41), an official of the French government asked him how much of Australia Great Britain claimed. 'I answered "the whole," and with that answer he went away.' Whether or no the expeditions of Freycinet, Bougainville, and Dumont d'Urville were affected by some hope of establishing a French colony somewhere in Australia, it is noteworthy that after Lord John Russell's emphatic declaration French exploration came to an end.

See De Brosses, *Histoire des Navigations aux Terres Australes* (2 vols., Paris, 1756)—really an obese pamphlet; its purpose is explained above; Bougainville, *Voyage autour du Monde* (Paris, 1766-9); Rochon, *Nouveau Voyage à la Mer du Sud* (Paris, 1783); Milet-Mureau, *Voyage de la Pérouse* (Paris, 1797); Rossel, *Voyage de Dentrecasteaux* (Paris, 1808); Labillardière, *Relation du Voyage à la Recherche de la Pérouse* (Paris, 1800); Péron and Freycinet, *Voyage de Découvertes* (Paris, 1807-17); Freycinet, *Voyage autour du Monde* (1827); Bougainville, *Journal de la Navigation autour du Monde* (1824-6); Dumont d'Urville, *Voyage de la Corvette L'Astrolabe* (1830); and Lesson's *Voyage autour du Monde sur la Corvette 'La Coquille'* (1839). Ernest Scott's *Terre Napoléon* (London, 1910) treats principally of Baudin's voyage, but also discusses the whole series of French expeditions.

E.S.

Exploration by Land. Phillip, when he planted his little colony on the shores of Port Jackson in January 1788 found before him what was literally an unknown land. What lay to the westward of Port Jackson, and behind the mountains he could see on the western horizon—especially what rivers were to be found—was a question that must have risen in Phillip's mind during his first days at Sydney Cove. The food problem required an instant answer to these questions; for, if the infant settlement was to become self-supporting, land more suitable for cultivation than the rocky precincts of the Cove must be found very soon.

Phillip lost no time in commencing his explorations. In March 1788 he visited Broken Bay, a branch of which he named Pitt Water after the then prime minister. In April he explored the northern side of the harbour, and saw in the distance the range now known as the Blue Mountains; the northern part of this he named Carmarthen Hills after the Marquess of Carmarthen, the southern part Lansdowne Hills, after the Marquess of that name. But the later name, 'Blue Mountains,' was adopted very early in the colony's life, as Collins in 1793 says that the mountains were commonly known by this name 'from the appearance which land so high and distant generally wears.'

On 22 April Phillip, with 11 officers and men, set out to search for a large river which he presumed would be found at the 'rising of the mountains.' The party did not reach the river, as their provisions ran short, but saw 'a country that might be cultivated with ease.'

His most important discovery in 1789 was the river he named after Lord Hawkesbury, then president of the council of trade and

plantations; this he discovered in June when exploring Broken Bay, and in the following month explored the river (and its tributaries the Macdonald and Colo), penetrated to the junction of the Grose, and ascended Richmond Hill. Meanwhile on 26 June Watkin Tench, accompanied by Arndell (assistant surgeon of the settlement), Lowes (surgeon mate in the *Sirius*), two marines and a convict, working westwards from Rose Hill (now Parramatta), discovered a river to which Phillip gave the name Nepean, after Evan Nepean, then under-secretary to the admiralty. The Nepean is the main stream of the Hawkesbury. This river rises as the Wollondilly; receiving the Cox, it changes name to Warragamba; when the Nepean enters, the main stream takes its name until the Grose joins it; from that point it is called the Hawkesbury.

In September Botany Bay was surveyed to the extent of 30 miles, and charted by Captain Hunter. In December William Dawes, with George Johnston and Lowes, crossed the Nepean River near the present railway bridge in an attempt to reach the Carmarthen Mountains. They penetrated about 15 miles in three days, and reached a hill which they named Mount Twiss. It is difficult to locate this hill, but (judging from the plan published in Tench's *Account*) it is the high ridge beyond the present Linden railway station—the same ridge from which Blaxland, Lawson and Wentworth in 1813 took bearings of the surrounding features. An expedition led by Tench and Dawes in the following August into the district SSW. of Parramatta entangled itself in the gorges of the Warragamba—which discouraged further research in that direction. Tench gives an interesting description of the method followed by these early explorers, at any rate up to Blaxland's time:

> Our method on these expeditions was to steer by compass, noting the different courses as we proceeded, and counting the number of paces—of which 2200 on good ground were allowed to be a mile. At night, when we halted, all these courses were separately cast up, and worked by a traverse table, in the manner a ship's reckoning is kept; so that by observing this precaution we always knew exactly where we were, and how far from home—an unspeakable advantage in a new country, where one hill and one tree is so like another, that fatal wanderings would ensue without it. This arduous task was always allotted to Mr. Dawes, who from habit and superior skill performed it almost without a stop or an interruption of conversation; to any other man on such terms it would have been impracticable.

In September 1793, William Paterson, who had previous experience as a traveller in Africa, set out with George Johnston, John Palmer, and Edward Laing to explore the Blue Mountains. Boats were sent round by the Hawkesbury River to Richmond Hill; Paterson then entered the Grose River (which he so named, presumably after Lieutenant-governor Grose) and proceeded up it for 10 miles, meeting with no fewer than five waterfalls. A high peak of land, 'which they had in view in the chasm, they called Harrington's Peak.' The party had by now encountered so many obstacles that it returned, 'leaving the western mountains to be the object of discovery at some future day.' In August 1794, says Collins,

> A passage over the inland mountains which form the western boundary of the county of Cumberland being deemed practicable, Henry Hacking, a seaman (formerly quartermaster of the Sirius, but left here from the Royal Admiral), set off on the 20th of the month, with a companion or two, determined to try it. On the 27th they returned with an account of their having penetrated twenty miles further inland than any other European. Hacking reported, that on reaching the mountains, his further route lay over eighteen or nineteen ridges of high rocks; and that when he halted, determined to return, he still had in view before him the same wild and inaccessible kind of country. The summits of these rocks were of iron-stone, large fragments of which had covered the intermediate valleys, in which water of a reddish tinge was observed to stagnate in many spots. The soil midway up the ascent appeared good, and afforded shelter and food for several red kangaroos. The ground everywhere bore signs of being frequently visited by high winds; for on the sides exposed to the south and south-east it was strewed with the trunks of large trees. They saw but one native in this desolate region, and he fled from their approach, preferring the enjoyments of his rocks and woods, with liberty, to any intercourse with them. These hills appearing to extend very far to the northward and southward, an impassable barrier seemed fixed to the westward; and little hope was left of our extending cultivation beyond the limits of the county of Cumberland.

It is impossible with the meagre particulars available to identify Hacking's route. One theory is that he passed Springwood ridge, and that he was the builder of the cairn afterwards called 'Caley's Repulse' (see CALEY, GEORGE).

In June 1796, Collins records, George Bass (q.v.) and two companions made an attempt to round the mountains to the westward, but from the summit of the first ridge saw 40 or 50 miles away another range extending N. and S. At a later date Bass personally gave Péron further particulars of his attempt; they experienced, he said, 15 days of unparalleled fatigue and danger, and the space between the first and the distant range presented 'obstacles and dangers equally great with those in his rear.' It is extremely probable, judging from the rough track and the mention of some very fine land,' that Bass worked along the northern side of the Grose valley and reached Mount King George or Mount Tomah. In 1798 a proposal was made by Banks to send Mungo Park, the celebrated African explorer, out to New South Wales to explore the country, Park should be provided with a decked boat of about 30 tons in the hope of penetrating to the centre of the continent by means of some navigable river. Hunter's opinion of the proposal was 'that altho' a thorough knowledge of the interior of this country is much to be desired, the gentleman design'd to explore it, would have (I may venture to say, from my own experience) found difficultys to surmount which I fear his experience in the interior of Africa could have given but little acquaintance with.' For some reason the proposed visit of Park was abandoned. About this time a number of convicts had a peculiar delusion. The idea gained currency among them that a white civilized people inhabited the interior somewhere south-westwards of the settlement. Accordingly many of them set out for this country, which was represented as a delectable land; the fact that a few returned without finding it proved, not that it did not exist, but that they had been unlucky; and the exodus continued. At last Governor Hunter determined to send out a party, allegedly to find the happy land, incidentally to do some useful exploratory work. He entrusted the leadership to an ex-convict named Wilson, who had passed most of his time in the bush, was an expert bushman, and possessed great powers of endurance. The party left

Parramatta on 14 January 1798, but before it was much past Camden there remained only Wilson himself, one other man, and a boy named Barracks who kept an excellent diary. By following the indications of this diary along the area traversed, R. H. Cambage has ascertained that the first journey was made S. to Mittagong and then W. to the Wollondilly, while in a second—for which Henry Hacking, accompanied by Wilson and Barracks, started from Prospect on 9 March—the track taken was via Mount Jellore, Berrima and Marulan to Mount Towrang near Goulburn. These explorations, like those of Barrallier next to be related, had no practical results; but they have been detailed here because, until Cambage went to work on them, it was frequently asserted that both Wilson and Barrallier had actually crossed the main range and approached the upper Lachlan.

Barrallier (q.v.) made two expeditions into the interior. During the first, which lasted about a fortnight, he penetrated about 50 miles SW. from Richmond Hill, and claimed to have discovered a new river. The second crossed the Nepean River on 6 November 1802, and in seven weeks covered about 140 miles from Parramatta. Barrallier wrote a full report, and prepared a chart of his explorations; but it was in later years found impossible to plot the chart on a modern map. R. H. Cambage, however, by following carefully the indications given in Barrallier's geological and botanical notes, traced the explorer's approximate course, and the following memorandum is his:

In his attempt to cross the Blue Mountains in November, 1802, Ensign Francis Barrallier started from Parramatta. He passed Prospect Hill and, leaving all habitations behind, crossed the Nepean River a few miles above Camden, proceeding past a swamp called Manhangle by the natives. His course took him near Picton and thence westerly to the edge of the gorge overlooking the Nattai River, where he formed a depot, and left his bullocks and waggon. He next followed the Nattai about six miles to its junction with the Wollondilly, proceeded up the latter past the Tonalli River, crossed the Wollondilly and went westerly to the Peak Mountains at Yerranderie, attempting the ascent of the South Peak. Here he met with unfriendly natives, which resulted in his returning to his depot at Nattai. In about a week he again started with five of the strongest men and two young natives, and, passing through the gap at the north end of the South Peak, arrived at Colong Creek near the site of the Colong woolshed. Still keeping a westerly course, he journeyed through a deep passage in the mountain (since named Barrallier's Pass) coming out near the head of Bindook Swamp. After following down this swamp, and crossing Bindook Creek, his westerly course was stopped by the precipitous sides of Gulf Creek. This resulted in his turning northerly and passing over to either Waterfall or Lannigan's Creek, which eventually led him to the Kowmung River. Had he turned westerly when on the ridge between Gulf and Waterfall Creeks, he could by a fairly easy grade have reached the Great Dividing Range at Mt. Werong in a few hours.

After reaching the Kowmung, instead of following this stream upwards, he unfortunately followed it downwards to Christy's Creek, and then decided to turn westerly up this stream, at the head of which he was finally stopped by a waterfall and precipitous cliffs, at about sixteen miles in a direct line southerly from Jenolan Caves.

Being short of provisions, and finding himself in one of the roughest parts of our Blue Mountains, this heroic explorer then decided to retrace his steps.

On 11 February 1802 George Caley started from Prospect on his first journey to the 'Cowpastures.' In June of that year King reported that Caley had made several excursions into the mountains; and he made further explorations in the same district in October and December 1802, February 1804, and August 1806. His most famous exploit was his attempt to cross the Blue Mountains in a westerly direction from Prospect, undertaken in the latter part of 1804. He began at the junction of the Grose and Hawkesbury Rivers, taking the north side of the Grose. As he advanced he found the country extremely rugged and barren, and the valleys for the most part almost impassable. After incredible fatigue he reached Mount Banks on the twelfth day after he left Richmond Hill, only to find an 'inaccessible valley' in front of him. His report on returning was consequently most despondent and King summed up the result of 18 years' labours in a mournful sentence:—

As far as respects the extension of agriculture beyond the first range of mountains, that is an idea that must be given up, as the rocks to the west of that range wear the most barren and forbidding aspect, which men, animals, birds, and vegetation has ever been strangers to, a better proof of which may not be adduced than the remark of one of Caley's party in returning, who exclaimed, on seeing two solitary crows 'that they had lost their way.'

In 1812 a drought forced on Macquarie the necessity of securing fresh pastures for the colony's flocks, which were growing too big for the narrow strip between the coast-line and the Blue Mountains. In 1810 Gregory Blaxland had made two excursions up the Warragamba River, one by boat, the other on foot along the south bank of the river; and, as the result of these explorations, he evolved the theory that the range might be crossed by keeping along the watershed between the Warragamba and the Grose. With the assistance and approval of Macquarie an expedition was equipped, and Blaxland, accompanied by Lieutenant Lawson (an experienced surveyor), W C. Wentworth (then a lad), and four convicts, set out from South Creek on 11 May 1813, crossed the Nepean at Emu Island the same afternoon, and the next day began the ascent of the first ridge. Travelling sometimes two miles and occasionally five per day, the party forced its way through almost impenetrable country, always heading the gullies and clinging to the actual ridge top. Soon after commencing the ascent of the second ridge a pile of stones was found, evidently the work of Europeans; its origin is discussed elsewhere (see CALEY, GEORGE). On the 28th Blaxland, having unconsciously diverged from the central ridge, found himself at the end of a spur since called Mount York, and with great difficulty brought his horses down the precipitous sides to a well-watered valley that gave prospect of good pasture-land. Finding this sort of country to extend sufficiently 'to support the stock of the colony for the next thirty years,' the explorers returned to Sydney. They had, as a matter of fact, not crossed the main range at all; that was left for Evans to do; but they had found a way through the remarkable obstacle presented by the formation of the Blue Mountains (in which almost all the valleys are bounded by cliffs many hundred feet high, so that Blaxland's plan of following the intervening ridges was the only possible solution); and, that done, the main range had no terrors.

In 1811 George William Evans (q.v) examined Jervis Bay and found his way back to Sydney by land after encountering great hardships. On

19 November 1813 he was despatched with a party of five to continue Blaxland's explorations. Reaching Blaxland's terminal point on the 26th, he struck southwards into hilly country, but soon reached a stream (afterwards called the Fish River) which he followed W. to its junction with Campbell's River; the united stream he called the Macquarie, and followed it for another 20 miles through grassy plains into a rugged gorge; being then nearly 100 miles beyond the Blaxland point, he returned to Sydney. His news was so acceptable that Macquarie ordered William Cox (q.v.) to construct a road over the mountains along the Blaxland-Evans track, and in 1815 journeyed by this road to Bathurst (just below the Fish-Campbell junction) in nine days. On 13 May Evans, who was one of the governor's party, left Bathurst on a journey which, taking him first southwards and then west, brought him on the 25th to the Lachlan River not far from its junction with the Abercrombie. These discoveries were confirmed and amplified two years later by John Oxley, who in April 1817 followed the Lachlan from Evans's last station into vast swamps, avoided them only to encounter more swamps, and turned back just when two days' further journeying would have brought him to the Murrumbidgee; and on 6 June 1818 led another party (including Evans) down the Macquarie to yet more swamps, sent Evans on a short tour in which he discovered the Castlereagh River, and then struck NE. and E. across the Warrumbungle Ranges and the Liverpool Plains, crossed the dividing range with great difficulty near the head of the Hastings, and reached the coast at Port Macquarie.

Meanwhile the southern areas had not been altogether neglected. In 1814 Hamilton Hume and his brother John followed (unknowingly) on Wilson's tracks and opened up the Wingecarribee district, Charles Throsby in 1817 extending the settlement area beyond Sutton Forest. On 3 March 1818 Throsby and Hume,

accompanied by Meehan, started from Liverpool in the hope of discovering an overland route to Jervis Bay; finding themselves entangled in the Shoalhaven gorges near Marulan, they separated and while Throsby managed to reach the Bay via the Kangaroo and lower Shoalhaven Rivers, Hume and Meehan worked along the high land W. of the Shoalhaven, discovered Lake Bathurst, and returned to Sydney past the Goulburn plains. In 1819 Throsby linked the two districts by a journey from Moss Vale through Taralga, Burraga and Oberon to Bathurst, and in 1820 Meehan, starting almost due W. from Moss Vale, reached the Lachlan and turned northwards to Orange and Wellington. On 19 August of the same year Joseph Wild discovered Lake George, and Macquarie visited it later in the year; in April 1821 Throsby reached the Murrumbidgee somewhere in what is now federal territory, and on 1 December Robert Johnston discovered the Clyde River, from which Hume and Berry in 1822 reached Braidwood. In 1822, too, Allan Cunningham, after investigating the head-waters of the Cox and botanizing on the upper Macquarie, opened a route between Bathurst and the Cudgegong River, where William Cox and his clan were settling. About the same time settlers of less note but equal zeal were working inland from Newcastle and northwards from the Hawkesbury to the Hunter, and preparing the way for that vigorous occupation of the Hunter valley which —side by side with that of the Bathurst and Goulburn plains—characterized the later years of Brisbane's governorship. The whole territory thus explored, from the Clyde River northwards to Port Macquarie and inland as far as Meehan's line of 1820, was under Darling converted into the 'Twenty Counties' beyond which settlement was not permitted; the rest of the colony remained crown land on which adventurous 'squatters,' slowly moving farther out,

depastured herds of cattle or flocks of sheep; and it was mainly to investigate this unknown expanse for squatting purposes that the next series of explorations was taken in hand.

On 22 May 1823 Captain Mark Currie, with Brigade-major Ovens and Joseph Wild, explored the district south of Lake George, reached the Murrumbidgee, and discovered some fine country, which Currie called Brisbane Downs; fortunately this name has been replaced by the native name, Monaro. In the same year Allan Cunningham left Bathurst on 15 April with the intention of exploring the country north from the Cudgegong River as far as the Liverpool Plains. He travelled up the Cudgegong, reached the Goulburn River, crossed the Wermyse, but then, turning north, was blocked by impassable mountains. Baffled here, he turned south and then west, found and named Blaxland's River on the 21st, crossed it, and travelled west back to the Goulburn.

Although provisions were considerably reduced, and the party weak, he determined to make another attempt to discover some pass through this range, and on 2 June proceeded NNE. Twice more he was baffled and had to turn southward again, and had almost determined to leave the ranges altogether; but one more ascent was decided on, and on 5 June the party camped in a valley which he named Hawkesbury Vale. Ascending the highest ridge to the westward to make a few observations, he was gratified by seeing through a considerable depression in the main range a clear but limited view of the plains to northwards. On 7 June, following this indication, he found and traversed 'Pandora's Pass.' Peach stones were planted in Hawkesbury Vale and on the plains north of it.

Another useful exploration of 1823 was undertaken by Archibald Bell of Richmond, who pioneered the track along the northern side of the Grose valley since known as Bell's Line (see Cox, William). The value of this route—which is both shorter and less rugged than the Blaxland line—has never been understood except by stock-owners in the Mudgee district, who up to the end of the century travelled their stock along it to the coast.

On 17 October 1824 Hume, accompanied by W. H. Hovell, a free settler who had been master of a merchantman, left Hume's station near Gunning (NW. of Lake George) on an expedition towards the southern coast. Brisbane —who authorized the expedition but left the explorers to pay their own expenses—wished them to make across country to Spencer Gulf; being their own masters, they designed a route in the direction of Bass Strait. On the second day out (the 18th) they crossed fertile pastures to which they gave the name McDougall's Plains, the aboriginal name being Yarh (i.e. 'running water,' a version of 'Yarra'); Yarh has since been corrupted into Yass, and silly stories have been invented to explain the corruption. Then, plunging into the tangle of hills south-westwards, and crossing stream after stream—the Murrumbidgee, the Hume (now known as the upper Murray), the Mitta Mitta, the Ovens, the Goulburn—they made several vain attempts to penetrate the Plenty ranges, emerged at last to the west of Mount Disappointment, and maintained their south-westerly course to the shores of Corio Bay. Unfortunately at the critical moment Hovell's calculations went astray, and he fixed their terminal point exactly one degree farther east than it actually was (38° 6′ S. lat., 145° 25′ E. long., instead of 144° 25′); this mistake made them think they had reached Western Port. In after years it suited Hume to allege that he had known of the mistake all along, and had been overborne by Hovell's supposed skill in calculation; but a letter which he himself wrote to Brisbane on 24 January 1825 shows that he at that time had no doubt about the identification. This expedition had two important results. In the first place, the discovery of so many important streams, all running west or north-west, produced the impression that somewhere in the Spencer Gulf region there must be a great river-outlet for all their waters, and so led to the first of the genuinely geographical explorations (Sturt's) that are recounted below. In the second place, the mistake about Western Port deferred the colonization of Port Phillip for ten years more. For Darling, urged by the colonial office to occupy Western Port, and assured after interviews with Hume and Hovell that it was the Western Port area they had traversed, sent off a small party by sea to settle there; when reports came back that the real Western Port was unsatisfactory for agriculture, the whole enterprise was abandoned, and the current of settlement was diverted to areas far north of Sydney. For a discussion of the many legends that have collected about this Hume-Hovell expedition see Hume, Alexander and Hovell, William.

Meanwhile the trend of expansion was for the time northwards, in which direction Oxley's report of the Liverpool Plains and Cunningham's discovery of Pandora Pass led eager pastoralists to look for good pastures. Lockyer in 1825 tried to work up the Brisbane River, but found himself blocked by the ranges in which it rises. Cunningham therefore on 30 April 1827 left Segenhoe on the upper Hunter to commence the most important of all his explorations. Reaching the Liverpool Plains by a pass west of Murrurundi, he crossed the Namoi near Gunnedah on 12 May, the Gwydir near Gravesend on the 21st, and the Dumaresq (Macintyre) on the 28th, finding a succession of fertile but narrow river-valleys separated by belts of what he called 'arid desert forests.' Consequently he diverted his course from N. to NE., climbed to the level of the tableland, and on 5 June struck the Condamine River where it enters the Darling Downs. On the 8th he saw from Mount Dumaresq a vast extent of good pastoral country, and on the 11th obtained from a gap in the main range near Maryvale a view of Mount Warning to the SE. and of the Moreton Bay district to the NE. An attempt to return due S. over the tableland was frustrated by the ruggedness of the country and the severity of the winter on those high plateaux, and he eventually came back to Segenhoe by a track rather westwards of his outward route. These important discoveries he tried to develop in 1828 by approaching the Downs from the coast, at first up the Logan valley past Mount Lindesay, then up the Bremer and between Mounts Mitchell and Cordeaux. The passage, however, when found on the second attempt, was so difficult that no use was made of it; a third attempt made by Cunningham to cross the ranges more directly W. of Brisbane was a failure; and the Darling Downs were in the end occupied by squatters following in his original inland track.

The task of opening up pastoral country was from this time onwards performed by the squatters themselves as they needed room. We come,

therefore, to the third stage of Australian exploration, during which the settlement of geographical questions was the explorers' main object, and the vague belief in (*a*) a big river-outlet on the south coast and (*b*) a big inland sea receiving the waters of westward-flowing rivers from the Lachlan northwards was their chief inspiration. The first, the boldest, and by far the most unfortunate of these explorers was Charles Sturt (q.v.), whose achievements are now to be recounted.

His first expedition, in which Hume accompanied him, started in drought time from Wellington on 10 December 1828, with the objects of tracing the course of the lower Macquarie and extending the boundaries of discovery westward. On 20 December 1828 Mount Harris, close to Oxley's terminal point on the Macquarie, was reached and a depot was formed; then, while the main expedition followed the course of the Macquarie by boat, Hume was sent forward on foot with two men to pick up the river-channel some way northwards. The boat-trip, however, met with little success, as the channel was soon lost in reeds and marshes. After excursions in several directions, the party on 17 January 1829 reached New Year's Creek (now known as the Bogan River), and the next day arrived on the banks of a river to which Sturt gave the name of Darling. To the great disappointment of the explorers the water was found to be salt, but they followed it for some 66 miles before returning to the depot at Mount Harris. They next turned northwards to investigate the Castlereagh River, discovered by Evans in 1818. This was found to be dry, but its course was traced for about 100 miles towards the Darling; the forbidding aspect of the country then determined Sturt to return, and the party proceeded homewards.

The colonial government now began to think about the unexplored Murrumbidgee, and Sturt was entrusted with the command of an expedition to determine the course of this river; his party included George Macleay (see MACLEAY, ALEXANDER), and Fraser the colonial botanist. The expedition left Sydney on 3 November 1829 and reached the Murrumbidgee on the 25th near the site of Jugiong. The junction of the Tumut River was passed, and the site of Wagga, and many plains, one of which was named Hamilton, after a staff-surgeon. Sturt then attempted to connect with Oxley's farthest point on the Lachlan, and reached that river, but was unaware that he had done so. At the end of December he determined to take to the water. A whaleboat had been carried from Sydney in sections, and these were put together, while a small boat (about half the size of the whaleboat) was built on the ground by the carpenter. Six men—Clayton, Mulholland, Macnamee, Harris, Hopkinson and Fraser—were selected by Sturt to accompany him and George Macleay. On 7 January 1830 the boat-journey began, with the skiff in tow, but on the second day the skiff struck a snag and sank, and two days were spent in recovering the stores from her. For a few days their way was through reeds, but these ceased and the river ran through open country. On the 14th the boat shot out into what Sturt described as 'a broad and noble river;' this a few days later he named the Murray, after Sir George Murray, who in 1828 was secretary of state for the colonial and war department. Hume had, of course, already discovered it and named it the Hume; but Sturt considered his discovery a new stream, to which the Hume, Ovens and Goulburn all contributed. It was decided to follow the Murray River westwards, and the ensuing voyage was full of incident, especially when they encountered aboriginals; the kindly firmness of both Sturt and Macleay, however, preserved friendly relations intact. Just after the most dangerous of these encounters, on the 23rd, Sturt saw 'a new and beautiful stream, coming apparently from the north;' this, after a short journey up it, he provisionally (and correctly) identified with the Darling whose upper course he had discovered in the previous year. Then the voyage down the Murray was resumed; the Rufus (a perpetual reminder of Macleay's red hair) and the Lindesay (now, as usual, misspelt Lindsay) Rivers were discovered and named; and on 9 February Sturt saw before him a lake which he named Alexandrina, after the princess who was to become Queen Victoria. With a view of rowing to St. Vincent's Gulf —where it was possible a vessel awaited them —an endeavour was made to get the boat into Encounter Bay, but all their efforts were fruitless. A return by the route they had followed was now their only salvation. The story of this return is one of the most heroic in Australian annals. Before it began Sturt describes his crew as 'very weak from poverty of diet and from great bodily fatigue,' and calculated that the meagre ration (¾lb. flour per day) could only be maintained if they made the same speed back against the current that they had made coming down with it. But there was no other way out: on the 13th they re-entered the river, pulled up it with occasional slight assistance from the wind, reached the Murrumbidgee entrance on 17 March (26 days down, 33 back —a notable record), and six days later arrived at the depot to find it deserted. The disappointment was very nearly fatal. For another 17 days the weary and half-starved men had to pull against a flooded Murrumbidgee, uncomplaining but past any strenuous exertion; often they fell asleep at the oars; one of them became delirious. At last Sturt camped and sent two men away to bring back help from a depot at Wantabadgery, and this arrived on the very day when the last ounce of flour had been consumed. By slow degrees they made their way back to Sydney, and there Sturt went blind for many months.

In 1831 a runaway convict named George Clarke gave himself up with a story of having discovered during his absence a great river known by the natives as 'Kindur,' and a fine country to the north of the Liverpool Plains. Major T. L. Mitchell (q.v.) then surveyor-general, who had displayed great jealousy when Sturt was chosen for the 1829 expedition, now obtained leave to go exploring, and started from Sydney on 24 November 1831. Crossing the Peel and Namoi Rivers (an effort was made to sail down the last-named river in canvas boats, but snags and shoals foiled the attempt), Mitchell reached the Gwydir, turned north, and in January 1832 discovered a river called Karaula by the natives, but now known as the Macintyre. At this point his progress was stopped by the failure of his supplies, which had been intercepted and looted by blackfellows, and four years elapsed before he was again at leisure for explorations. But his earlier supersession by Sturt still rankled, and he was anxious to prove that explorer was wrong in his supposition that the Darling joined the Murray. So on 9 March 1835 he started

from Parramatta with a party that included Richard Cunningham, brother of Allan, as botanist; by 15 April he had reached the Bogan, and while here Cunningham was killed by the blacks—at any rate he wandered away from the main body, botanizing, and was never seen again. On 25 May the junction of the Darling and Bogan Rivers was reached, and to Mitchell's great delight the country was now well grassed; 15 miles down stream, therefore, he made a depot and erected a stockade, which he named Fort Bourke, and on 8 June he started down the river and followed it for some 300 miles. Mitchell was less tactful than Sturt, and a serious affray with the blacks, during which some of them were shot, marked this excursion.

Though the junction of the Darling with the Murray was now almost certain, it had not been actually demonstrated. To clear the matter up one way or the other Mitchell on 17 March 1836 left Orange in a dry season to follow Oxley's tracks down the Lachlan, which he still hoped to be the river that Sturt had mistaken for the Darling. Finding, however, that it joined the Murrumbidgee as Sturt had said, he marched across country to the Murray and along the Murray towards the Darling, made quite sure that it was the Darling, and then returned to the Murray-Murrumbidgee junction. Here he crossed the big river and proceeded along its southern bank to Swan Hill; then, striking south and south-west through a region that seemed to him—fresh from the dry Lachlan-Murray-Darling area—verdant and even paradisaical, he crossed the Avoca, the upper Avon and Wimmera (where they were still streams, not rain-water channels), and the Glenelg, which he followed partly by land, partly in a boat, to its mouth in Discovery Bay. He had started this expedition with memories of his war service in the Peninsula, and they did not leave him—his track is still marked by names such as Nivelle, Pyrenees, Arapiles, Trafalgar. From the Glenelg he marched ('marched' is the exact term for describing Mitchell's expeditions, so military were they) eastwards to strike the Hume where it had been first crossed, but was diverted to the coast again by viewing from the hills unexpectedly a settlement of white men on Portland Bay (see HENTY, EDWARD); resuming his march, he on 30 September climbed Mount Macedon and saw in the northern corner of Port Phillip 'a mass of white objects, which might have been either tents or vessels.' As Henty had preceded him in the west of Victoria, so Fawkner forestalled him eastwards. But it was Mitchell's discoveries, not Henty's or Fawkner's or Batman's, that settled Victoria during the next 15 years: squatting, not whaling or small farming, was the colonizing agent in those days.

The obviously needed connection between this new pastoral region and the just-founded colony of South Australia was supplied by the journeys of Edward Eyre (q.v.) and Joseph Hawdon in 1837. Thenceforth the main fields open to explorers were (*a*) the mysterious central region, (*b*) the vast stretch of country between the Darling Downs and the settlements in the far north of Australia, (*c*) the long coast-line, first and to this day least known of all Australian shores, between Swan River and Port Essington, (*d*) the strip along the Bight where South Australia might be linked up with Western Australia. This last exploration was undertaken by Eyre in 1840-1, and is described under his name. Chronologically the next after Mitchell's great journey was George Grey's investigation of the north-western coast at two widely separated points. In February 1838 he, with Lieutenant Lushington, made an expedition into the interior from the head of Prince Regent's River in Brunswick Bay. The most important discovery was that of the Glenelg River on 2 March; and in the ranges adjoining were found a number of extraordinary rock-paintings, which are still the subject of controversy (see ABORIGINES, under section *Decorative Art*). On 17 February 1839 Grey landed on Bernier Island in Shark Bay, discovered the mouth of the Gascoyne River, and began a boat-journey down the coast. Through a series of disasters the party had to abandon the boats at Gantheaume Bay and walk thence to the Swan River (a distance of some 300 miles); after great privations the party reached Perth in detachments.

The opening up of Gippsland by Angus McMillan and Count de Strzelecki, and the extension of pastoral occupation over the Darling Downs to the Burnett valley by Patrick Leslie and Henry Stuart Russell, are narrated under the names of the men responsible for them. More adventurous, though far less productive, was Sturt's great journey of 1844-5, instigated by the failures of Eyre (1840) and Frome (1843) to penetrate beyond the salt plains of Lake Torrens. The authorities in London suggested that he should take the line from Port Augusta northwards which Eyre had already sampled and discarded; Sturt's own choice was to evade the supposed barrier of Lake Torrens by following up the Darling to its great bend near Menindie and then striking north-west into the unknown. Great preparations were made, and the party was the largest and best equipped yet seen in Australia—12 men besides the leader, 3 carts, 200 sheep, 11 horses and 30 bullocks. Among the party were James Poole, second in command; John Harris-Browne, surgeon; and McDouall Stuart, draughtsman; and Eyre, then resident magistrate on the Murray, accompanied them as far as Lake Victoria. On 15 August 1844 the expedition left Adelaide; Laidley's Ponds (Menindie) was reached on 11 October, and Sturt decided to make for some distant ranges which Poole had seen to the north-west 'rising like islands out of a vast sheet of water.' Reaching these (the Barrier Ranges) near the present Broken Hill and travelling north along their western slopes, always lured a little farther by the discovery of some small creek or pond of fresh water that dried up almost under their eyes, the party on 12 January 1845 found near what is now Milparinka an apparently permanent creek issuing from a low range of hills, and on the 27th pitched tents beside it. Sturt considered it a convenient resting-place before his next advance. It was in fact for nearly six months his prison. Northwards no water could be found, southwards the drought had destroyed all the pools. The heat was terrific: 'the ground' Sturt wrote, 'was thoroughly heated to the depth of three or four feet . . . . under its effects every screw in our boxes had been drawn . . . . horn handles and combs were split into fine laminae. The lead dropped out of our pencils . . . . our hair as well as the sheep's wool ceased to grow, and our nails became as brittle as glass.' By May even the native birds had migrated, and the waterhole had shrunk from nine feet in depth to two. Sturt kept his men as busy as possible, surveying for 30 miles the line along which he proposed to move when the rain did

come. On 12 July a few drops fell, and by the night of the 13th it was falling steadily. Sturt had already decided to divide the party, sending most back to Adelaide so as to economize provisions for the rest; Poole, who was nominally in charge of this section, but was very ill, died almost at once and was buried under Mount Poole; Sturt with the rest of the party moved a few miles on and established a new depot at Fort Grey. After a reconnaissance westwards, which by extreme ill-luck brought up against the salt waters of Lake Blanche (thus confirming the belief that Lake Torrens extended right across the central area at this point), Sturt with four men and provisions for 15 weeks made north-west in the hope of finding a mountain range somewhere near the continent's centre. The rain had not really broken the drought; he crossed Strzelecki Creek and Cooper's Creek and the Diamantina River, hardly noticing them as creeks, but finding beyond the last-named channel that 'stony desert' which for many years was to preserve his name on Australian maps, yet is in ordinary seasons a very minor obstacle to travel. This he crossed also, and the desolate sand-hill region beyond it, and the salty spinifex ridges at the head of Eyre Creek; on 8 September he attained the point known only as lat. 24° 40′ S., long. 138° E., and thence was forced to retreat to the depot, then 443 miles away. He reached it on 2 October; on the 9th he was away again, heading due north from the crossing of Strzelecki Creek, striking Cooper's Creek where its channel was over 200 yards wide—and then meeting the stony desert once more. A second time he pushed through it, a second time was forced (on 21 October) to retrace his steps towards the depot, the water at each creek-crossing or waterhole failing before his eyes. But as soon as he reached the comparatively permanent supply of Cooper's Creek he started with renewed energy to trace it upwards towards its source. On 3 November he found its channels dispersed among grassy plains, and the natives (with whom he always kept up friendly relations) assured him that no water would be found farther east—it is in fact at this point (long. 142° E.) that the course of the creek bends sharply from north-south to east-west. By this time Sturt himself was breaking down under the long-continued hardships, and a return to the main depot became inevitable. On 13 November it was reached—and found empty, the men left there having been compelled by the failure of the water-supply to fall back on the old Rocky Glen station. Here Sturt found them on the 17th, and at once collapsed with scurvy. No rain had fallen since the July storms; the drought was earlier and worse than in the previous year; to dare another summer was certain death, to venture across 270 miles of probably waterless country to the Darling was little better. But it was better; on 6 December the party set forth (Sturt for the first time carried on one of the drays), found enough water along the route to keep them alive, and on the 20th camped by Lake Cawndilla. Still too ill to mount a horse, Sturt was brought by slow stages to the Murray and so on 19 January to Adelaide. Never before or since in Australian history has such persistent daring met with such ill-success.

Sturt's disaster checked explorations in South Australia for nearly 10 years. The scene shifts, therefore, to central Queensland, and to the less hazardous but much more profitable discoveries of Ludwig Leichhardt. This explorer, whose good fortune for a long time concealed his amateurishness, arrived in New South Wales in 1842, and for two years studied natural history in the Moreton Bay district. He hoped to be made naturalist of an expedition under Sir T. L. Mitchell, intended to open up a road from the Darling River to Port Essington, but finally determined to lead a party of his own. On 1 October 1844 he left Jimbour on the Darling Downs; passing the Condamine River, he discovered and named the Dawson River and the Comet, Planet and Zamia Creeks. On 9 January 1845 he crossed the Mackenzie River, on 13 February the Isaacs, and shortly afterwards the Suttor; but the most important discovery made in these regions was that of the Burdekin, which was followed up inland until, crossing the main watershed, Leichhardt picked up a stream flowing to the Gulf of Carpentaria, named it the Lynd, and followed it down to the Mitchell. On 28 June the party was attacked by blacks and the naturalist, Gilbert, was killed and two men wounded. From the Mitchell Leichhardt travelled along the shores of the Gulf, crossing a number of rivers, the principal of which were the Gilbert and the Roper. On 6 August the party reached a river which was identified as the Albert of Captain Stokes; but this was afterwards found by A. C. Gregory to be a mistake, and the river was named the Leichhardt. On the Roper the party lost four horses, and Leichhardt had to sacrifice the whole of his botanical collection. On 17 December the expedition, in an exhausted condition, reached Victoria on Port Essington after a journey of ten months' duration, one of the most successful Australian explorations.

Meanwhile on 15 December 1845 Mitchell, having at last obtained leave from the authorities in London, set out on his last journey of exploration to find what Leichhardt had just discovered—a route connecting the settled districts of New South Wales with its distant province in the far north. His design was to make north across country until he struck a westward-flowing stream whose outlet might be in one of the great bays of the north-western coast. Starting, therefore, from Boree near Orange, he crossed the Macquarie and Barwon, marched up the Narran, struck the Culgoa-Condamine on 1 April 1846 at a point where it is usually known as the Balonne, followed it and its tributary the Cogoon to Fitzroy Downs (9 May), worked westwards across the upper Maranoa to the head streams of the Warrego, and made north across the upper Nogoa (11 July) to the Belyando, rejecting river after river as it became evident that they were running in the wrong direction. The Belyando, which he followed for more than 200 miles, was the most misleading of all; on 8 August he had to retrace his steps towards the Warrego, and striking due west across the Nive valley suddenly found himself (15 September) on a fine stream running north-west, 'the realization' as he wrote prematurely, 'of my long-cherished hopes.' Certain that this was a headstream of the Victoria River—whose mouth lay on the north-west coast, only 1200 miles away—he bestowed that name on the infant Barcoo, which is also called in its later stages Cooper's Creek; so sure, indeed, was he that he hurried at once back to Sydney with the news; but in 1847, Kennedy, sent back to make sure of the great discovery, followed the stream past its fatal south-westerly turn to its junction with the

Thomson, blighted Mitchell's hopes, and came back down the Warrego. It is noteworthy, however, that Mitchell's journeys, futile as they might be in respect of their geographical aims, invariably opened up good pastoral country, and thus contributed to the spread of settlement in much greater measure than did those of either Sturt or Leichhardt.

After the success of his first expedition, Leichhardt had no difficulty in securing funds for a second, which had for its ambitious object the crossing of the continent from east to west. This expedition left Stephens's station on the Condamine on 10 December 1846, lost all its stock, and on 6 July 1847 was back on the Condamine, ill and half-starved; for lack of anything to do, Leichhardt then made a short excursion to the Balonne River and back. In no wise dishcartened by this abject failure, in 1848 he organized a third expedition with the same object. He could, however, obtain little satisfactory support, and for his second in command had to depend on a German brother-in-law whose sole qualification was that 'he had been at sea, had suffered shipwrecks, and was, therefore, well able to endure hardships.' The expedition started from Moreton Bay. A letter written by Leichhardt on 3 April 1848 and preserved in the Mitchell library at Sydney gives an account of the party up to that date; in 11 days they had travelled from Burrell's station on the Condamine to Macpherson's on Fitzroy Downs and everything had gone very well. This is all we know of the expedition. Not one certain relic of the party or its equipment has ever been recovered. It is practically certain that they reached the Elsey River, a tributary of the Roper; for in 1856 A. C. Gregory found there a hut which, from his characteristic manner of building one, and its relative position to the fire and water supply, was identified as one of Leichhardt's. In 1852 Hovenden Hely with a search party found two camps with trees marked L on the Nivelle River, and in 1858 Gregory discovered a tree on the Barcoo marked in the same fashion. McIntyre later found another 'L' tree and two old saddle-marked horses on a tributary of the Cloncurry. Nothing else is known of the fate or the route of the party, though various impostors (two of them prisoners hoping to procure a release) between 1857 and 1881 pretended to have either relics or news.

On 29 April 1848 E. B. Kennedy, who had been second in command of Sir Thomas Mitchell's last expedition and subsequently leader of a party of his own, set out with 12 men to find a road up the York Peninsula. The expedition was transported by sea to Rockingham Bay (about midway between Townsville and Cairns), where it landed on 30 May. Kennedy's instructions were to proceed to Port Albany on Cape York, where a schooner would meet him. From the start trouble dogged the expedition; almost impenetrable marshes, scrubs full of lawyer-vines and stinging trees, hostile blacks, and hunger beset them perpetually. On 9 November Kennedy decided to leave eight of the party in camp at Pudding Pan Hill near Weymouth Bay, while he pushed on with three men and a black boy (Jacky Jacky) to reach the waiting vessel at Cape York. Of the five Jacky Jacky was the sole survivor. A gun accident made their progress for three weeks very slow; then Kennedy decided to leave the three men near Shelburne Bay, and to push on with only the black for company. Kennedy's strength began to fail; he almost reached the end of the journey, for he caught a glimpse of Albany Island from a height; but there the blacks closed in and speared him. Jacky was wounded but dragged himself, sometimes less than a mile a day, to the vessel at Port Albany. On hearing his story the captain sailed at once, but no trace could be found of the three men at Shelburne Bay, and of the eight left at Weymouth Bay six were dead from starvation.

Apart from these large-scale explorations in eastern Australia stand a series of smaller and less hazardous, but no less useful, journeys in the areas bordering the west coast undertaken by the brothers Gregory, J. S. Roe—who in 1848-9 traversed the little-known region east of the York-Albany line—and Robert Austin, who in 1854 investigated the area between Lake Moore, Lake Austin and the Murchison.

Leichhardt was last heard of in 1848. In 1852, when he had been gone four years and should have long before made his appearance at some point on the coast, his friends equipped an expedition under Hovenden Hely to search for traces of the missing men. Blackfellows led him to various white men's camps on the Maranoa, Warrego and Nivelle, but none of these was ever satisfactorily identified with Leichhardt's journey. In 1855 the command of an expedition was given to A. C. Gregory; the design was to traverse northern Australia in a west-east direction, keeping a good look-out for traces of Leichhardt on the way. On 18 July 1855 Gregory (taking Dr. Mueller—better known afterwards as Baron von Mueller—as botanist) left Sydney in the *Monarch* and landed near the mouth of the Victoria River in Queen's Channel on 24 September. The river was thoroughly investigated until it was lost in sandy and barren country about lat. 18° S.; crossing an invisible watershed, Gregory traced Sturt Creek (as he called it) for about 300 miles SW., and was forced to turn back, as a forbidding desert stopped his advance. Returning to the lower Victoria, he arranged that a schooner belonging to the expedition should go to the mouth of the Albert River in the bight of the Gulf of Carpentaria, while he himself with Dr. Mueller and five others travelled overland. Starting on 21 June 1856, they soon struck Elsey Creek, where they found what may have been a camp of Leichhardt's; the creek led them to the Roper, which they soon left to make for the Albert rendezvous, travelling parallel to the Gulf coast but some distance inland. The Nicholson took them to the Albert, but the schooner had not arrived, and Gregory determined to proceed overland instead of by sea. A note was buried at the foot of a marked tree and on 3 September the party turned homewards, paralleling and sometimes retracing Leichhardt's first route, until they reached the eastern coast at Port Curtis. Gregory had been away 16 months, and had covered about 5000 miles. Although Leichhardt's fate was still a mystery and the new country had not proved of much value, yet the expedition was considered a great success, and in 1858 Gregory was entrusted with a second. On this occasion he used the Warrego-Nive-Barcoo route opened up by Mitchell and Kennedy, reaching the Barcoo on 17 April. He then proceeded to the Thomson, and followed it up for some distance but was turned back by the absence of grass; returned to its junction with the Barcoo and followed the latter down until it merged into Sturt's

Cooper's Creek; diverged southwards along Strzelecki's Creek, and passing between Lakes Frome and Torrens reached Adelaide. This achievement, though it added little to geographical knowledge, altered considerably the impressions of central Australia left by Sturt's drought-stricken journeys, and important results followed immediately.

Sturt, it will be remembered, had by ill-luck confirmed the impression that Lake Torrens spread in a great horseshoe so as to cut South Australia off entirely from the interior, and Gregory himself in 1856 asserted that 'the remainder of the unexplored interior is a desert, or at least unfit for the habitation of civilized man.' But the South Australians, whose western boundary at that time was the line of long. 132° E., and who wanted to extend it to coincide with that of Western Australia in 129° E., in the same year sent B. H. Babbage into the arc of the horseshoe, and he found reason for a more favourable report; the next year G. W. Goyder, the assistant-surveyor-general, extended Babbage's track to the shores of Lake Blanche (which Sturt had found so discouraging from the northern side) and found them well-grassed and well-watered; and, though his superior officer A. H. Freeling only a few months later found stony deserts and saline deposits on those same shores, private enterprise was at the same moment opening up good saltbush and grass country to the west of Lake Torrens. So, early in 1858, Babbage was commissioned to examine the new region, work up the western side of Lake Torrens as far as possible, and attempt to round its northern side and connect up with Sturt's track. As usual, his efforts were much hindered by the steady shrinkage of water-supplies, but he made two important discoveries—that well-sinking could provide ample water when the surface supply failed, and that on the western side at least of Lake Torrens the supposed water barrier was a chain of lakes, not a single stretch of water. At the same moment Gregory on the eastern side of Lake Blanche was making the same discovery; his dramatic arrival in Adelaide emphasized his announcement of it; and local discontent with Babbage's slow progress ran so high that he was superseded by Colonel Warburton (the commissioner of police), not, however, before he had in a spasm of unwonted activity penetrated to the shores of Lake Eyre South and made it probable that there was a clear break between that lake and Lake Torrens.

Two other expeditions of these years deserve notice before we take up again the story of the great explorers. In June 1857 Stephen Hart conducted a party from Streaky Bay to examine the inland areas northwards; he discovered Lake Gairdner from the western side, and reported good pastoral country towards the colony's boundary, thus strengthening the case for removing that boundary westwards. And in 1858 John McDouall Stuart, who had been restless ever since his return with Sturt, made a dash past Babbage through the Torrens-Gairdner area, struck out into the north-western unknown, enclosed the Stuart Ranges in one loop of an S-shaped track and the Warburton Ranges in the other, and reached Streaky Bay half-starved but optimistic. It was, indeed, his report as much as Gregory's that told so heavily against Babbage.

All these unexpected discoveries, breaking down almost simultaneously the pessimist theories for which Eyre's and Sturt's misfortunes and Leichhardt's disappearance were responsible, provoked a remarkable reaction at the centres of Australian enterprise. 'Philosophical' societies (as the taste of those days named what we call 'learned' societies) took up with enthusiasm projects for inland exploration. In Sydney one lecturer suggested a quasi-military expedition convoying great herds and flocks and preceded by an organized force of black trackers; another went so far as to envisage balloons. Victorians, stirred by the persistence of Dr. Mueller, who had formulated several theories during his journey with Gregory, more slowly worked themselves up into the spirit that despatched Burke and Wills. South Australia—which colony, after all, stood to profit most by the opening up of the real interior—did less as a colony than the others: its Philosophical Society had apparently exhausted its enthusiasm over Babbage, and its government was too poor to subsidize big expeditions: yet it was from South Australia, where the adventurous zeal of McDouall Stuart was backed by the private generosity of W. Finke and J. Chambers, that the first actual effort came. In 1859 Stuart merely extended the Babbage-Warburton discoveries round and beyond Lake Eyre as far as the Hanson Range; but in 1860 he launched out definitely on an attempt to traverse the continent from south to north, and on 22 April, having passed through the Macdonnell Ranges, climbed and named Central Mount Sturt (which Governor MacDonnell promptly altered to 'Stuart'). Pushing steadily on—at first west of north, then east of north—into spinifex country where hostile tribes attacked him, he was on 27 June forced to retreat; but he had already overlapped Gregory's extreme southward limit (Gregory had traced Sturt Creek to lat. 20° S., Stuart had passed lat. 19°), and his achievement received its merited reward. The government voted £2500 to equip a second expedition, with which he started at the end of the year, reaching Bonney Creek (a little short of lat. 20°) on 12 April and following its waters for some distance in the hope that it might lead to the Victoria River. When this hope failed, he returned to his earlier route due north, and managed to penetrate the scrublands for 100 miles beyond his 1860 terminus, but was again forced back; 'the plains and forest' he wrote, 'are as great a barrier as if there had been an inland sea or a wall built round.' His failure was in some degree soothed by the news that for his first journey he had been awarded the Royal Geographical Society's gold medal. Chambers and the government between them at once set to work to organize a third expedition, which started in December 1861, reached Newcastle Waters (his 1861 terminus) on 14 April 1862, and after much casting about—in the manner of hounds on a lost scent—broke through the scrub past Daly Waters to the Strangways. Down the Strangways to the Roper, up the Roper to the Chambers, up the Chambers across a 'beautiful' tableland to the head-waters of the Adelaide went Stuart and his now excited party, until on 17 July they plunged into the mud and mosquitoes of the alluvial coast-lands and on the 24th dipped their hands in sea-water at Chambers Bay, just east of the Adelaide mouth. The return trip, however, was in part disastrous; the horses died off, the natives harassed them, Stuart himself became paralysed and blind for a time; but before Adelaide was reached he had partially

recovered, and was able to enjoy the honours and rewards that were showered on him.

After all, he was not the first to cross the continent from tidal waters to tidal waters. While he was wearily retracing his steps from the first rebuff near Attack Creek, the zeal of Dr. Mueller and the generosity of the Melbourne public had sent on its way the most costly, most tragic, and least effective expedition in Australian annals. The object of the expedition was to reach the Gulf of Carpentaria via the Darling River and Cooper's Creek. £12,000 (£1000 given by Ambrose Kyte, £6000 voted by the government and £5000 subscribed by the public) was raised for it. The command was entrusted to Robert O'Hara Burke (q.v.) with the following staff:—second in command, G. J. Landells (who quarrelled with Burke before the settled districts were passed, and returned to Melbourne); astronomical and meteorological observer W. J. Wills (q.v.), who on Landell's resignation succeeded to the position of second in command; medical officer and botanist, Herman Beckler; artist, naturalist and geologist, Ludwig Becker; ten white men, and three camel-drivers (25 camels had been specially imported from India for the expedition). After a slow passage the party reached Menindie; here Burke formed a depot, left behind the greater part of his staff and equipment, and set out with six men and 15 camels to reach Cooper's Creek. The manager of a neighbouring cattle-station, William Wright, joined the expedition as third in command and guided Burke over a better route than Sturt's. On 11 November Cooper's Creek was reached, and a camp-site selected; Wright was sent back to bring up the remainder of the party, and for six weeks Burke impatiently awaited his return. At last he could restrain his impatience no longer, and determined to 'dash into the interior and cross the continent at all hazards' with the resources at his disposal. He left four men, six camels and four horses at the depot under the charge of Brahe, and on 16 December 1860 plunged into the interior with Wills, King, and Gray, six camels, one horse and 12 weeks' provisions. The party appears to have at first pursued a NW. course by way of the McKinlay Range, but soon struck a stream running almost directly northwards, and so were led to cross the Dividing Range on to the head-waters of the Cloncurry. This river led them to the Flinders, which they followed until it widened into an estuary. Burke's brief diary for 28 March 1861 says:—'At the conclusion of report it would be as well to say that we reached the sea, but we could not obtain a view of the open ocean, although we made every endeavour to do so.' Having, however, reached tidal waters, the honour of being the first to cross the continent is usually awarded to Burke and his companions. On 21 February the return journey was commenced, and on 21 April three emaciated figures staggered into the depot at Cooper's Creek—the fourth, Gray, had died on the way (according to some reports, had been killed) and was buried in the bush. Only seven hours before their arrival Brahe (who had been ordered to wait three months, and had actually waited more than four) had departed on the home journey, leaving a supply of provisions and a letter. The party, he wrote, had remained four months at the depot; Wright had not come up with the supplies; the blacks were troublesome, and the provisions exhausted. Burke, instead of following Brahe, insisted on making for Mount Hopeless, 150 miles away, relying on Cooper's Creek for water; but before leaving he buried a letter in the hole in which Brahe had left the provisions, smoothing it over, unfortunately, so that there was nothing to show that the provisions had been disturbed. Life for the unfortunate men now became a mere struggle for existence. They existed for a time on the seeds of the nardoo (q.v.), and natives occasionally gave them fish; but they had no bush-lore to teach them where ample food-supplies might be obtained—they never thought of catching fish for themselves. Wills succumbed first; Burke died two days later; King made himself useful to a native tribe, and was supported until the rescue party under Howitt reached him.

There has been, as is natural, much discussion about the causes of this tragic failure; but there is no necessity to go beyond the character of the leader. Burke was incompetent, and over-ambitious of the glory of being first across the continent. He was brave, no doubt, but other qualities are required in an explorer. He blundered in dashing off from Cooper's Creek without assuring himself that his reserves at the Darling were on the way to the Creek. He blundered in leaving his scientific staff hanging about on the fringe of the settled districts while he made a dash for glory. After his return to the Cooper's Creek depot he made three bad blunders. He could have followed Brahe's party, which was but 14 miles away on 21 April. Instead of burying the letter in the very hole Brahe had made—and smoothing the surface so that, when the latter rode back a few days later, he concluded from the absence of any signs that the explorers had not returned—he could have left some visible sign of his return. A few strokes with a tomahawk would have made the difference between life and death. He blundered most of all when, instead of making friends with the natives and copying their methods of obtaining food, he merely took what they could spare. King, who made himself useful, was given his share of the common stock. Brahe meanwhile had met Wright on the Bulloo, returned with him to the depot (where, as has been said, he noticed no signs of the explorers' return), and, growing anxious, made back to Melbourne at his best speed to urge the Royal Society to send out search parties. This, however, had been already done. Brahe met Howitt with the first on the Loddon, and returned with him to Cooper's Creek, which was reached on 8 September, and the depot on the 13th. After two days' search King was found, 'wasted to a shadow, and hardly to be distinguished as a civilized being except by the remnants of clothes on him,' but at any rate alive, and able to tell the story of the others. He guided them to Wills's grave; Burke's body was found on the 21st; Howitt buried the two decently, but on his return to Melbourne was instructed to go back again and fetch the bodies to that city, where they were given a public funeral.

When Brahe's first news reached Melbourne, arrangements were hastily made to send out three other search parties in addition to Howitt's. John McKinlay was put in charge of a party starting from Adelaide north-east; William Landsborough was directed to land at the foot of the Gulf of Carpentaria and work southwards; Frederick Walker, a superintendent of native police in Queensland, was sent in westwards from Rockhampton. It was not then known, of course, that Burke had come

back to the depot at all, and it was considered that one of the four parties must inevitably come upon his tracks towards the Gulf. In the end the journeyings of these searchers cleared up practically all the mysteries still left in eastern Australia, and by January 1863 there was no field left for exploration on a large scale east of long. 138°.

One Queensland Burke-and-Wills-relief party was under the charge of William Landsborough; it left Brisbane in the brig *Firefly* on 24 August 1861. The *Firefly* went ashore on one of Sir Charles Hardy's Islands on the way, but was refloated, and the party safely reached the mouth of the Albert in the Gulf of Carpentaria. A new river discovered by Landsborough was named the Gregory (after the explorer) and on 21 December the Herbert River was found and named—this stream has, however, been renamed the Georgina. An attempt to proceed westwards failed from lack of water; when Landsborough again on 8 February reached the depot on the Albert, he learnt that Walker had found tracks of Burke and Wills on the Flinders, and determined to make for home by that river instead of by sea. The Flinders was reached on 19 February, and the fine pastoral country through which it runs seen for the first time. Crossing to the head-waters of the Thomson, he followed that stream to the Barcoo, and on 21 May arrived at Williams's station on the Warrego. Landsborough's report led to the pastoral occupation of a large portion of the district he travelled through.

McKinlay's party left Adelaide on 16 August 1861 and on 27 September crossed Lake Torrens; from thence to Lake Hope the journey was through a dry and stony country. Leaving a depot at Lake Buchanan, McKinlay made for the Barcoo; in this region the blacks pointed out a grave, and on opening it Gray's body was found; this led McKinlay to believe other blackfellow stories of the killing and eating of white men, and to call a lake in the vicinity Lake Massacre. On his return to Lake Buchanan news reached him of the discovery of the bodies of Burke and Wills; but, as he was well supplied with provisions, he determined to continue his explorations northwards. On 17 December he set out again in a north-easterly direction, was held up by lack of water at Lake Hodgkinson (now known as Lake Apanburra, NW. of Innamincka), but on 10 February 1862 made another start, and in March crossed a large creek which he called Mueller, but which is now known as the Diamantina. The tracks of Burke were picked up in two or three places. On 6 May McKinlay reached the Leichhardt River, and on the 18th came to the tidal waters of the Gulf of Carpentaria, but the dense growth of mangroves prevented him (as it had Burke) from reaching the sea. After an unsuccessful attempt to reach the mouth of the Albert River, where a depot had been formed for the relief parties, he turned off on 21 May to reach the settled parts of Queensland through country already explored by Leichhardt and Gregory. 'To him' wrote Sir Dominick Daly to the secretary of state, 'belongs the credit of having demonstrated the practicability of driving sheep and horned cattle across the continent.'

The fourth search party was despatched from Rockhampton on 7 September 1861 under the command of Frederick Walker. On 27 September he reached the Barcoo, which he followed down for three days, finding traces of Gregory and Leichhardt; from the Barcoo he crossed to the Alice, then to the Coreena (a tributary of the Thomson), then to a river which he named the Barkly—in reality the head of the Flinders. On 25 November the junction of the Norman and Flinders was reached and the tracks of Burke and Wills discovered, and Walker then made across the Leichhardt to the Albert River depot. After a rest, he started again, followed the tracks of the unfortunate explorers to their ninth camp, and after a toilsome journey reached Strathalbyn station on the lower Burdekin on 4 April 1862. A fair area of good country was opened up by this expedition.

Before narrating the series of explorations which opened up, more or less, the western half of the continent, we may deal with two minor expeditions in the north-east. The Imperial government having decided to establish a settlement called Somerset on Cape York, at Albany Pass, John Jardine of Rockhampton was selected to command the new settlement, and arrangements were made for his two sons to take a herd of cattle overland to Somerset. Frank Jardine, the leader, was only 22 years of age; his brother Alexander was 20. The expedition started on 11 October 1864 from Carpentaria Downs station down the Einasleigh and up the eastern shore of the Gulf. Up to 13 December, when the party reached the Mitchell River, the explorers had endured a long list of troubles. Lost horses, burnt provisions, persistent and ferocious attacks by natives, united with the character of the country, make the record read like that of the ill-fated Kennedy. They crossed several rivers which they provisionally identified with those on Flinders's map—the Archer, the Coen, the Batavia—and by 17 January only 15 were left of the 42 horses with which they had started. On the 20th the two brothers started ahead to find a less difficult track to the settlement, and became entangled in the bends of a large river now known as the Jardine, which they thought was the Escape. Impenetrable country forced them to return, but on a third attempt they met with some blacks who greeted them with 'Alicko! Franko! Tobacco!' and led them to the settlement. John Jardine had taught the blacks in the vicinity of the settlement these three words, so that his sons might know they were his friends.

On 21 June of the same year Duncan McIntyre left the Paroo River with the intention of examining the country towards the Gulf of Carpentaria. Cooper's Creek was reached, and the tracks of Burke and Wills and McKinlay were followed to the north. Some 300 miles from the sea McIntyre found two old saddle-marked horses, and a short distance away the traces of two camps and two trees marked 'L;' he naturally concluded that these were relics of Leichhardt's party. On his return to the settled area interest was again aroused in the fate of the lost explorer, and a Victorian committee organized a search party, the command of which was given to McIntyre; when, however, the party reached Cooper's Creek,, the waterhole that McIntyre was trusting in was found dry, a retreat was ordered, and the expedition ended ignominiously. McIntyre subsequently reached the Gulf of Carpentaria, where he caught fever and died.

On 25 May 1861 Frank T. Gregory started from Nichol Bay on the north-western coast of Western Australia, discovered and named the Fortescue River and the Hammersley Range, and after some difficulty crossed the latter into the basin of the Ashburton. From this point the

party returned to Nichol Bay. After a rest Gregory started eastward, crossed the Sherlock and Yule Rivers, and on 26 August reached the De Grey. This river was followed for a time, and then, after crossing an immense plain, the Oakover River was found and followed up. As it bore too much to the west, Gregory left it and passed easterly through a small range to a sandy desert where he and his companions nearly lost their lives. He was forced to return to the Oakover and down it and the De Grey to Nichol Bay, which he reached on 17 October. Though thwarted beyond the Oakover, Gregory in this expedition opened up splendid pastoral country and greatly benefited the colony.

From 1864 to 1869 there was a lull in Australian exploration. The eastern colonies, in which practically all the utilizable land had been opened up (though great areas of it were still unused), were fully occupied with political problems and the extension of railways into their more closely settled districts. Western Australia, a mere patch of which was peopled, had neither funds nor energy to deal with the unknown interior; it was a crown colony, still under very definite control of the British colonial office, and had no certain prospect of owning the immense inland region, which in any case was apparently one huge desert. It was only the revival of stories about Leichhardt that induced the Western Australian government to fit out in 1869 an expedition intended to investigate one of these stories, derived from native sources. Dr. Mueller, who had stirred the government to action, was offered the command of the expedition; when he could not accept, it was entrusted to John Forrest (see FORREST, BARON). Starting from Perth, on 26 April he reached Yarraging, then the most easterly run in the colony, and on 18 May arrived at a dry salt lake (which he named Lake Barlee) near which, the story went, Leichhardt had been murdered. Finding no corroboration of the story, and being troubled by hostile blacks, Forrest determined to examine the country eastward as far as possible. With one black boy he pushed 100 miles into the desert, but all he got was a view of desolate spinifex country, open sandy plains, cliffs, and samphire flats. The party returned to Perth on 6 August.

The Western Australian government now decided to revive exploration. In 1870 it determined to despatch a party eastwards with a view of discovering a practicable route for a telegraph line to South Australia. This route had not been attempted since Eyre's journey of 1840-1. John Forrest accepted the command, and with his brother Alexander started from Perth on 30 March; the schooner *Adur* was despatched to accompany the expedition round the coast calling at various points to supply stores. Warned by Eyre's experience, Forrest kept a line somewhat inland from the bight, and so discovered that beyond the barren coastal zone there was good grazing country, deficient in permanent water. In 1871 Alexander Forrest was sent to explore the area now known as the Yilgarn and Coolgardie goldfields: he started from York on 11 August, made east for three months through barren country that seemed to him useless (little he dreamt of the gold beneath it!), turned south at a point about 100 miles east of Coolgardie and reached the coast by way of a well-grassed but badly watered region halfway between Port Esperance and Israelite Bay.

The next attempt to cross the western wastes was made from the north-south telegraph line which South Australia constructed in 1870-2 along the route originally taken by McDouall Stuart, and which obviously formed an excellent 'jumping-off place' or terminus for journeys from South to Western Australia and vice versa. In August 1872, just when the telegraph line was completed, Ernest Giles started westwards from Chambers' Pillar, was blocked by the bed of a salt lake which he named Lake Amadeus (the influence of Dr. Mueller is apparent in many of the foreign names given about this time to features of the Australian landscape), and was back at the Pillar by 18 November. The next year he started with W. H. Tietkens from Macumba, hoping to round Lake Amadeus to the south; in this he was successful, reaching the Rawlinson Range and seeing from it a line of hills—the Alfred and Marie Range—which is still merely an entry on the map; but he suffered a great deal from the hostility of the natives, and never was farther west than 125° E. Before he had even started on this journey, however, a more pretentious expedition, fitted out by two rich South Australians and provided with camels, had left Alice Springs on the telegraph line under Colonel Warburton (q.v.) on 15 April 1873 with the intention of traversing the region between the Macdonnell Ranges and Perth. In an unsuccessful attempt to reach the Sturt Creek discovered by Gregory in 1856, he got within 20 miles of it, but could not locate it. Troubles came thick and fast on the party. Eight of the 17 camels were gone, the provisions were almost exhausted, sickness crippled the men, myriads of black ants prevented sleep at night, and each day brought its struggle for water. When the party was at the last extremity, Warburton decided to abandon the attempt to reach Perth and to make for the Oakover River, at least 150 miles away. The diary of his journey across the desert to this river, which was reached on 5 December, is a record of starving and thirsting. Warburton did not expect to live through the journey, and the credit of bringing the party through is due to his companion Lewis and a native named Charley. The Oakover was followed down for some distance, but, as no signs of settlement were found, the indomitable Lewis took two camels and started in quest of assistance. The others 'waited and starved on the flesh of the last camel.' Lewis rode 170 miles to a station and on 29 December arrived back at the camp with a relief party. The wastes had been crossed; but Warburton had been too hurried to make any observations outside his actual tracks. Warburton was followed from Alice Springs on 23 April by W. C. Gosse, also in search of a transcontinental route to Perth. Gosse followed, roughly speaking, the track taken by Giles in 1872, and, like Giles, was forced to turn back by the inhospitable desert.

Warburton's dash across the northern desert had no practical results; but in 1874 John Forrest and his brother Alexander left Yuin on the Murchison (lat. 28°, long. 116°) on 13 April, followed the river to the Robinson Ranges (near the head of the Gascoyne), and then struck across waterless country SE. to the Murchison watershed, then NE to Weld Springs (where the party was attacked by blacks, and it became necessary to fire on them), then, after much casting about, SE. and E. through spinifex country, 'a barren worthless desert,' where scouting for water was the principal occu-

pation of each day. At last Forrest found himself only 100 miles from Gosse's farthest point; in front of him was the desert that had thrown back both Giles and Gosse. The conquest of this desert proved a tedious and strenuous task, but at last a providential shower of rain filled some rock-holes, and allowed the party to cross. Soon afterwards an old camp of Giles was picked up, and from here the tracks of Gosse and Giles were followed until on Sunday 27 September the overland telegraph line was reached. 'Long and continued cheers came from our little band, as they beheld at last the goal to which we have been travelling for so long.' Forrest afterwards said that the country round the Murchison was admirably suited for pastoral settlement, but he did not think the country from the head of the Murchison to the 129th meridian would ever be settled. Nor is it.

In 1875, undaunted by his previous failures, Giles was once more in the field. Thomas Elder equipped the party, which included 19 camels: but camels, however useful for crossing deserts, in some way discourage those who use them from the detailed investigation of the country passed through. A start was made from Youldah on 27 July 1875, and the party reached Perth on 10 November, after travelling a distance of 2575 miles in about five months. Giles summarized the trip as follows:—'The expedition has been successful, yet the country traversed for more than a thousand miles in a straight line was simply an undulating bed of dense scrub, except between the 125th and 127th meridians, the latitude being nearly the 30th parallel. Here an arm of the Great Southern Plain ran up and crossed our track, which though grassy was quite waterless. The waters were, indeed, few and far between throughout. On one occasion a stretch of desert was encountered in which no water was obtainable for 325 miles, which only the marvellous sustaining powers of Mr. Elder's beasts enabled us to cross. The next desert was only 180 miles to a mass of granite, where I saw natives for the first time on the expedition. They attacked us there but we managed to drive them off. Mount Churchman was now only 160 miles distant, and we found water again before reaching it.' Giles rested at Perth for two months and on 13 January 1876 started back again; this time he struck north to the Murchison, crossed to the Ashburton and, passing over 150 miles of desert, reached the Alfred and Marie Range from which the desert had thrown him back in 1873. The party reached the Peake telegraph station on 23 August 1876.

With Giles's last expedition ended the period of important explorations. Eastern Australia had been thoroughly opened up by 1863; Sturt and Stuart had laid bare the central region; Gregory had penetrated from the north as far as Sturt Creek. By the end of 1875 the western wastes had been thrice crossed—by Forrest, Giles, and Warburton—and their general character ascertained. Of minor expeditions, each filling in some small blank on the map, short notices must suffice.

In May 1876 W. O. Hodgkinson, sent to examine the pastoral country west of the Diamantina River, discovered between that river and the Herbert a stream which he named the Mulligan. This was the last expedition fitted out by the Queensland government. In 1878 Buchanan, crossing from the Queensland border to the overland telegraph line, discovered a creek (Buchanan's Creek) which afforded an important watering place between the border and the telegraph line. In 1879, a railway line between Brisbane and Port Darwin having been projected, Ernest Favenc was sent to explore the line of country. Leaving Blackall, the party reached the Diamantina, then struck NW. through unexplored country between the Burke and Herbert to Buchanan's Creek; the telegraph line was struck in January 1879 at Powell Creek station. In 1889 Favenc traced the heads of the rivers running into the Gulf of Carpentaria, and David Lindsay explored a portion of Arnhem's Land, leaving Port Darwin on 4 June and proceeding via the Katherine and the country north of the Roper to Blue Mud Bay.

The next series of journeys concerned Western Australia. On 25 February 1879 Alexander Forrest started from the De Grey River towards the overland telegraph line; he followed the coast to the Fitzroy, and that river until he struck the King Leopold Range. For six weeks he endeavoured to penetrate this range, but had to abandon the attempt, finally working round its southern end. On 24 July a fine river was discovered and named the Ord, and on 18 August the Victoria River was reached. During the next few weeks the rations were almost expended and the party suffered severely from want of water. At last Forrest rode for the line with one man; on the third day one of horses knocked up, and the line had to be reached on foot. This expedition opened up valuable country in the northern part of Western Australia.

There followed several years of great activity along the north-western coast. John Forrest in 1883-4 surveyed the area inland from King Sound. Harry Stockdale in 1884 pioneered the district near Cambridge Gulf, while surveying parties connected up the Fitzroy and Ord valleys. In 1888-9 Favenc explored the head-waters of the Gascoyne and Ashburton. In 1896 the Calvert Exploration Expedition investigated the deserts between the upper Murchison and the Fitzroy, and in the same year David Carnegie, starting from Doyle's Well (not far NW. of Leonora), traversed the wastes NNE. to Kimberley without discovering either goldfields or good pastoral country. From the South Australian side Tietkens in 1889 worked W. from Alice Springs along the tropic of Capricorn round Lake Macdonald, and David Lindsay in 1891 travelled from Gosse's 1873 terminus near the Warburton Range SW. to the Fraser Range near Norseman, and then NW. through the Coolgardie district to the Murchison. A longer and, in the end, more profitable expedition was that of F. H. Hann in 1896-8. Starting from Lawn Hill on the Gulf of Carpentaria, he made west across country to the Ord, followed that river south to Hall's Creek and, after a vain attempt to cross the desert to the head-waters of the Oakover, followed the Fitzroy down to Derby, thence visiting Broome, Condon and Roebourne. From the last-named place he tracked the Fortescue to its source, crossed the watershed to Nullagine and thence to Derby, and devoted the rest of his time to investigating the region east of the King Leopold Range, which turned out to be the valley of the upper Fitzroy and its tributaries. His latest discoveries were confirmed, and the whole area between King Sound and Cambridge Gulf traversed and roughly surveyed, by an expedition under F. S. Brockman which the Western Australian government sent out in April 1901.

Apart from the journals of the various explorers, which are numerous and often well-written, and their biographies (among which that of Charles Sturt stands out), the best authorities for the general history of Australian exploration are Favenc's *History of Australian Exploration, 1788-1888*, and Calvert's rather pretentious *Exploration of Australia* in 2 vols., which brings the story up to 1896. Among detailed studies of particular epochs may be noted, Threadgill's *South Australian Land Exploration, 1856-1880*, published by the Public Library of South Australia, which deals with primary authorities—official records, journals, sketch-maps, etc.—in a way that should be widely adopted. A shorter and more popular compendium of the main facts is Favenc's *Explorers of Australia*, published in Christchurch, New Zealand, in 1908.

Exploration by Sea. This summary of the exploration and survey of Australian waters (i.e., the coastal waters of the mainland, Tasmania, and the adjacent islands) commences with the discoveries of Captain Cook on the east coast. For earlier voyages and visits (known or supposed) of the Spaniards, Portuguese, and Dutch see AUSTRALIA, DISCOVERY OF, also PELSART, FRANCIS and DAMPIER, WILLIAM.

Cook.—For the *Endeavour* and the earlier part of his first voyage see COOK, JAMES. After observing the transit of Venus at Tahiti and circumnavigating the coast of New Zealand, Cook decided to return by way of the East Indies, making westwards until he fell in with the eastern coast of New Holland and then following it 'until we arrive at its Northern extremity; and if it should be found impracticable, then to Endeavour to fall in with the Land or Islands discovered by Quiros.' This is the reason given in his own words for the course steered, and is an effectual answer to an often-repeated assertion that his discovery of New Holland was an accident. What was known of Australasian waters on board the *Endeavour* was, briefly, that Tasman had laid down the southern point of Tasmania and the western coast of the North Island of New Zealand. The discoveries on the western coast of Australia were merely a few names on the chart. New Guinea had been discovered by the Portuguese more than 100 years earlier, but practically nothing was known of it. Torres had, of course, long before passed through the straits which bear his name, but this was not known for certain when Cook sailed; he however, believed that New Holland and New Guinea were separate islands, for he writes: 'we have now put this wholly out of dispute, but as I believe it was known before but not publicly I claim no other merit than the clearing up of a doubtful point.' At daybreak on 20 April 1770 land was sighted eight leagues away by Zachary Hicks the senior lieutenant. (This date, which differs from that given in Cook's own log, is the correct one according to modern computation. As explained under COOK, JAMES, all Cook's log-dates from 4 October 1769 to 9 October 1770 are incorrect by one day, since he had not when passing the 180th meridian of longitude made the change of date which is now customary.) The land first seen was named after the officer who sighted it. Its exact position is probably that of a hill 924 feet high now marked on the chart as Point Hicks Hill, near Sydenham Inlet. Cape Everard is close by, and it is generally accepted that this cape may be taken as Cook's starting-point on the Australian coast. A detailed discussion of the question will be found in the *Victorian Historical Magazine*, vols. ii and v. From this point Cook worked northwards along the coast, naming conspicuous landmarks or noting a description of them in his journal or logbook. Close to the Five Islands (near Wollongong) at a spot he named Red Point, an attempt was made to land, but the surf was too great; and at 2 p.m. on Sunday 29 April the *Endeavour* anchored in Botany Bay, the north head of which he named Cape Banks and the south head Point Solander. At 3 p.m. Cook, Banks, Solander and Tupia (a native of Tahiti who had volunteered to accompany the *Endeavour* to Europe) landed. A legend preserved in the Cook family states that Cook ordered the midshipman of the boat to land first. 'Jump out, Isaac' said he; so that Isaac Smith—a cousin of Mrs. Cook who survived (as Admiral Smith) to a great age—was actually the first man ashore. As the boat approached the shore, a few blacks came down, but soon ran away, except two who boldly opposed the landing. A musket was fired over their heads, and one threw a stone. A charge of small shot was then fired, to which the blacks replied with a couple of spears; a second discharge drove them off. The ship lay about half a mile from what is now known as Kurnell on the south shore, the extremes of the bay bearing E. to SE½E. During the stay of the ship a seaman, Forby Sutherland (according to the log; probably Forbes), died of consumption and was buried on 1 May at Point Sutherland. Before leaving, an inscription was cut on a tree near the watering-place giving the ship's name and the date. All traces of this tree have been lost; but two monuments at Kurnell (as the area south-east of Botany Bay is now called) are usually considered attempts to indicate the precise landing-place. One of these, a tablet put up in 1822 by the Philosophical Society of Australasia, was not so intended: indeed, the inscription on it was deliberately so worded as to avoid the claim. The second, an obelisk erected in 1870 by Thomas Holt, is contiguous to the rocks on which in all probability Cook first landed. A discussion of the whole question will be found in the *Journal* of the Royal Australian Historical Society, vol. x, pp. 240-251.

During their stay Cook, Banks, Solander and some of the principal officers of the *Endeavour* made short excursions inland, but saw nothing noteworthy—unless we may reckon as noteworthy Cook's discovery (possibly near Sans Souci at the mouth of George's River) of 'as fine meadow as ever was seen,' which Phillip's expedition 18 years later was unable to re-discover.

On 7 May Cook weighed anchor about 7 a.m. and stood out through the heads to resume his northward voyage. His official log (which, unless otherwise stated, is the particular log followed in this article) contains the following entry for noon of that day: 'The extr's of the land from N5°E. to S. b. W½W. abreast of an open bay; dist. off the nearest shore, 2 or 3 miles. Lat'd. obs., 33° 47'.' This open bay was the mouth of Port Jackson, seen between North and South Head, with Middle Head blocking it and resembling the bottom of a bay. Hawkesworth's version of Cook describes it as 'a bay or harbour in which there appeared to be a good anchorage and which I called Port Jackson.' About sunset on 7 May the *Endeavour* was off some 'broken land, like a bay, N. 48° W. Shore dist. 2½ leagues.' From this phrase the present Broken Bay—the mouth of the Hawkesbury River—takes its name. The

much-discussed problem whether or no the entry actually refers to Broken Bay is dealt with under BROKEN BAY.

On 16 May the ship was off the north head of the Tweed River, which he called Point Danger; on the 17th he saw and named Cape Morton after the Earl of Morton, president of the Royal Society in 1764-8, who took a prominent part in originating the expedition. Hawkesworth ignorantly changed the spelling to 'Moreton,' and the incorrect form has been retained. On 23 May, after rounding Breaksea Spit, a second landing was made to obtain fresh water, and someone shot a bustard of 17½ lb.; Bustard Head and Bustard Bay commemorate this landing. They now crept along the coast, lowering boats frequently to sound and explore, and sometimes anchoring for the night. From 28 May their track lay among the numerous small isles that stud the chart between 20° and 22° S., and on 4 June they entered Whitsunday Passage. On the 6th, when off what is now Townsville, they found their compass much disturbed by the nearness of Magnetic Island.

On 11 June at 11 p.m., after sounding in from 20 to 17 fathoms, the ship struck on some rocks which proved to be the edge of a coral reef a little N. of Weary Bay. She was not making much water, but was bumping hard; so in the morning Cook started 30 tons of fresh water and hove overboard some condemned stores, the iron and stone ballast, and six guns and carriages. At 10 p.m. on the 12th she was got afloat, but after midnight the leak began to gain on the pumps, and at 3 a.m. there was 45 in. of water in the hold. A sail into which hair, oakum and wool were sewn was passed under the bows and so dragged over the leak (the expedient is known as 'fothering'), and by this means one pump kept the hold free, the ship making only 15 inches in an hour. A boat was sent on to look for a likely spot to beach and repair the ship, and on 18 June she was anchored in Endeavour River, and the task of lightening her began. On the 22nd she was hauled well up the bank on the south side of the river, with her bow among the mangroves, and when the tide went down it left her nearly dry. The rock, it was found, had cut through three planks on the starboard bow and injured three others, leaving a piece wedged in the hole. On 4 July the ship was afloat again but still leaking, so they erected a staging, brought the ship alongside it and continued the repairs until 20 July; adverse winds then detained them within the bar, but after a thorough overhaul, and with a renewed stock of fresh water and some turtle, they got under way and put to sea on 6 August. During their stay natives came to the camp occasionally, but no progress was made in getting to know them. They refused the presents offered them, but were anxious to obtain turtle-meat, and when that was denied them attempted to seize it, fired the grass round the camp, and at last had to be driven off with small shot. Cook and his officers surveyed the country from the neighbouring hills and agreed that, though it looked wild, it would doubtless if inhabited yield all that man could wish for.

Their course from this time was full of difficulties, as the Barrier Reef closed in towards land, and the ship could only be navigated by continually stationing an officer at the mast-head. At last they saw what Cook hailed as an opportunity of getting outside the Barrier, and passed through 'Cook's Passage,' a little north of Lizard Island. Cook, however, was not content to leave the newly discovered coast; he wanted to know whether New Holland and New Guinea were joined. He had with him a copy of De Brosses' *Voyages*, published in 1756, which contained charts he considered tolerably good with regard to New Guinea. 'I always,' he wrote, 'understood before I had sight of this map that it was unknown whether or no New Holland was one continued land, and so it is said in the very history of voyages these maps are bound up in.' With this in his mind he stood W. again on 15 August, but on the 17th it fell calm and the ship began drifting rapidly towards the breakers; the boats were got out, and with difficulty towed her clear. 'In this truly terrible situation' wrote Cook afterwards, 'not one man ceased to do his utmost, and that with as much calmness as if no danger had been near.' A light breeze sprang up, an opening was seen, the ship steered for it, and soon passed through Providential Channel and was once more at anchor inside the Barrier. From this time onwards Cook picked his way, with the boats ahead almost all the time, until on 22 August he passed the strait between Cape York and New Guinea. Then, landing for the last time on Australian soil, he hoisted the English flag and 'at 6 possession was taken of this country in his Majesty's name and under his colours: fired several volleys of small arms on the occasion, and cheered 3 times, which was answer'd from the ship.' In the King's and the admiralty copies of Cook's journal the name is given as New South Wales, and in a letter to John Walker of Whitby (his old employer) dated 13 September 1771 Cook wrote 'The East Coast of New Holland or what I call New South Wales.' Cook had intended to land on Cape York, but a tribe of aborigines threatened to oppose the landing; to avoid bloodshed he made his landing on Possession Island, two miles off the western shore of the cape. Satisfied that he was through the straits, Cook now set all sail, but narrowly escaped running on a reef near Booby Island; at first he made for the New Guinea coast, but, taking into consideration the health of his people and the state of the ship (which was still leaking), he decided that it was not worth while to survey coasts already explored by the Dutch, and so made for Savu near Timor, where he refreshed the crew. He reached Batavia on 11 October, and England on 13 July 1771.

The officers chiefly responsible for the survey and observations under Cook were Green the astronomer and Molineaux the master. All the officers, however, took a part in the work, and Forwood the gunner and Saunders and Monkhouse, midshipmen, are mentioned as taking observations. With this help Cook compiled the *Chart of the East Coast of New Holland by James Cook 1770*, on which he wrote in more than 100 names of places. The 150 years that have elapsed since then have, of course, brought about corrections and additional details; but the accuracy of his positions (which was, no doubt, chiefly due to Cook himself and to Green) is often remarkable, especially as there was no chronometer on board the ship, and the longitude had usually to be found by lunar observations.

Cook's second voyage in command of the *Resolution* (in company with Tobias Furneaux in charge of the *Adventure*) has no great importance so far as Australia is concerned. The

ships left England on 13 June 1772 and parted company early in February 1773, after entering the Antarctic circle. Cook, having gone as far south as he considered prudent, altered his course for Tasmania, where he intended to call on his way to New Zealand, but met with a heavy gale and sea and ran before it direct to Dusky Bay in New Zealand. On 11 May the *Resolution* made Queen Charlotte Sound; here they found the *Adventure*, which had put into Adventure Bay in Tasmania, stayed there five days, and then sailed north along the coast till it trended away to the west. Furneaux, who believed that Tasmania was part of the mainland, took this westward trend to indicate a deep bay, and decided to head for the New Zealand rendezvous. Cook accepted Furneaux's opinion on this point, and went off to Tahiti to recruit and then make south again in pursuit of the main object of the voyage—the search for an Antarctic continent. The rest of the *Resolution's* voyage is outside the scope of this article except for the fact that Norfolk Island was discovered on 10 October 1774. In the end Cook, having thoroughly traversed the Southern Ocean, felt that the southern continent (if it existed) was so far south, so deep in the ice region, that further exploration would not be worth the cost and risk involved; he therefore headed for England, which he reached on 30 July 1775. He sailed again on his third and last voyage in the *Resolution* (accompanied by the *Discovery*, Charles Clerke in command) on 12 July 1776, primarily to search for land in the Indian Ocean reported by Kerguelen, then to explore such North American inlets as seemed likely to lead to the Atlantic. On 26 January 1777 the ships arrived at Adventure Bay, and on 12 February were in Queen Charlotte Sound, whence they proceeded to Tahiti. After calling at various islands they reached the Sandwich Group where the career of the illustrious navigator was ended.

The authorities for the voyage of the *Endeavour* are Cook's charts, logs (official and private) and journal, the last containing details not to be found in the bare entries of the logs. A literal transcription of the original MS. of the journal, published in 1893, was edited by Captain (afterwards Admiral Sir) W. J. L. Wharton, hydographer to the admiralty, and a marine surveyor of the highest eminence. The MS. itself, after being lost for many years, was re-discovered in 1922 and purchased by the Commonwealth in 1923, and is now in the Mitchell Library at Sydney. The journals of Banks and Parkinson give useful additional details. The first volume of the *Historical Records of New South Wales* contains extracts from Cook's logs, and from journals kept by officers on the ship. Kitson's *Life of Cook* (Murray, London, 1911) gives a short and fairly accurate summary of Cook's work, and it has been excellently summarized in Wood's *Discovery of Australia*, cc. xxii-xxiv. Besides these there are a great number of 'Lives' of Cook in which the authors achieve remarkable success in avoiding the task of telling what Cook did.

Phillip, etc.—Phillip in his instructions was directed to use the *Sirius* and the *Supply* when possible to explore 'the several ports or harbours upon the coast, and the islands contiguous thereto, within the limits of your government.' As the King's commission gave him authority over a territory extending from Cape York to the South Cape of Tasmania and over all islands in the Pacific Ocean within the latitudes of those capes, the limits of his exploration were confined, practically, to such parts of it as had already been discovered by Captain Cook; eastwards, however, he had great scope. The survey of Port Jackson was begun by Hunter early in February 1788 and went on as often as opportunity offered until Hunter sailed for the Cape of Good Hope in October; it was revived soon after he returned on 9 May 1789. The survey of Broken Bay and Botany Bay was also carried on, Phillip himself taking an active part. The charts thus made were so accurate and detailed as to be sufficient for all practical purposes until Sydney became one of the principal seaports of the world, and the increase in the size of ships made extreme accuracy necessary. Phillip had no opportunity of examining the coast, as the ships were required for more important work; the survey of the harbour and bays was begun with boats, and one or two handy schooners were acquired later. Phillip's other explorations are enumerated under EXPLORATION BY LAND; but it should be noted that the sea was his main highway, and many of his expeditions started in boats from bases at Manly or at Botany Bay. The discovery of Lord Howe Island and the settlement at Norfolk Island are recounted under the names of those islands.

The *Francis*, a schooner-rigged vessel of 41 tons which had been sent out in frame from England, was launched on 24 July 1793—the first vessel launched in Australia—and did good service in coastal exploration. Some of the transports, too, added a little to the knowledge of the coast-line, especially those that were temporarily equipped as whalers (see WHALING) after landing their human cargo. The brig *Mercury* in 1789 visited and named Cox Bight in southern Tasmania and Oyster Bay on the inner side of Maria Island. In 1791 (a year prolific in this kind of discovery) the *Atlantic*, a transport in which Lieutenant Richard Bowen (see BOWEN, JOHN) was naval agent, put into Jervis Bay in August, and Bowen named the bay after Sir John Jervis (afterwards Lord St. Vincent) under whom he had seen active service; he also made a rough chart of the bay. In November the *Matilda* put into the same bay to stop a leak, and her master made an 'eye-sketch' of it. In December the *Salamander* put into Port Stephens, and her master made a similar sketch of the port and some of its branches.

On 21 August 1788 Bligh in command of the *Bounty* called in at Adventure Bay on the east coast of Tasmania, which he had previously visited when in the *Resolution* under Cook. Early in May 1789, during his famous boat-voyage after the mutiny aboard the *Bounty*, he noted several islands and bays and refreshed his crew with booby-birds on Cook's Booby Island, west of Cape York. Edwards in the *Pandora* was wrecked on a reef at the entrance to Torres Straits on 28 August 1791; and Bligh in the *Providence* (with Portlock in the *Assistant*) made the passage of the straits on his second voyage in 1793. The chart is strewn with names commemorative of these vessels and voyagers.

Lieutenant John McCluer—a distinguished surveying officer in the East India Company's service whose charts of the eastern coast of India remained practically unaltered for nearly half a century—on 16 July 1791 in the *Panther* (with Proctor in the *Endeavour*) started a survey of the northern coast of New Guinea which lasted two months; an important inlet which he discovered still bears his name.

Lieutenant John Hayes (q.v.) in 1793 sailed

from Calcutta to open up trade with New Guinea, but found it necessary to take the route round Australia, and on his way visited southern Tasmanian waters; the French admiral, Bruni D'Entrecasteaux, had during the previous year visited this coast and surveyed the channel which still bears his name (see EXPLORATION, FRENCH). Hayes in April-June 1793 thoroughly examined the Derwent estuary, and then proceeded to visit the SE. and N. coasts of New Guinea as well as several island groups in the near Pacific. On her passage to England the vessel carrying his charts and journal was captured by a French warship, and the documents are believed to be at the present time housed in some French public institution.

Bryant's party (see BRYANT, WILLIAM) in their boat-voyage of 1791 along the eastern coast entered a fine harbour said by them to be in 30° S.—which was, however, probably Port Macquarie (31°26′) discovered by Oxley in 1818.

In September 1797 the *Cumberland* was on her way to the Hawkesbury when she was seized by a part of the crew; the coxswain and three others, who would not take part in the seizure, were landed at Pittwater, proceeded overland to Port Jackson and gave information. Lieutenant T. G. Shortland of the *Reliance* was sent after the escapees in a good whaleboat; he found no traces of them in Port Stephens, but on his return entered a river about 10 leagues SW. of Port Stephens, on whose shores he found a considerable quantity of good coal lying so near the waterside as to be conveniently shipped. This was, of course, the estuary of the Hunter.

The *Sydney Cove*, from Calcutta to Port Jackson, was wrecked on Preservation Island (one of the Furneaux Group) on 8 February 1797; 17 of her crew, many of whom were lascars, embarked in the long-boat and attempted to reach the mainland; the boat was capsized near Cape Everard, but her crew landed and travelled along the coast in the hope of reaching Sydney. The party (two officers, three white seamen and 12 lascars) began its journey on 15 March, and on 15 May reached Coalcliff, about 14 miles S. of Botany Bay; here the smoke of a coal fire they had made attracted the attention of the settlement fishing-boat, and three survivors were picked up and brought to Sydney. Hunter despatched the *Francis* schooner and the sloop-rigged boat *Eliza* to the rescue of those who had been left on Preservation Island; what cargo could be salved was taken on board, six of the shipwrecked crew volunteered to remain behind in charge of the rest, and the *Francis* and *Eliza* sailed for Sydney on 21 June, the *Francis* arriving after a stormy passage 15 days later, while the *Eliza*, which had separated from her consort soon after leaving Preservation Island, was never afterwards heard of. In August 1797 George Bass (q.v.) was despatched in a whaleboat to Coalcliff, and there found the skeletons of some of the castaways, who had died of exhaustion before their comrades were rescued. About 21 miles from the south head of Botany Bay he discovered good coal,—but difficult of access, he reported, unless a good harbour could be found near it. So began our knowledge of the Illawarra coal-field.

In September 1791 Vancouver in H.M.S. *Discovery* (with Broughton in the *Chatham*), after rounding the Cape of Good Hope on his way to take over Nootka Sound from the Spaniards and survey the North American west coast, discovered and named King George's Sound in Western Australia. The Middleton Reef and adjacent banks were reported from time to time by transports and whalers bound north; the Middleton was first seen by J. Shortland in the *Alexander* in 1788, and the *Supply* in 1798 was sent specially to fix its position. The whaler *Chesterfield* and the storeship *Shah Hormuzear* in 1793 attempted some exploration in boats in Torres Straits and along the Barrier Reef, so that they were six months on the voyage to Timor. On 29 June natives attacked one of the boats, killing four of the seamen and wounding others. Two Spanish ships on a voyage of discovery, the *Descubierta* and the *Atrevida*, arrived in Port Jackson on 13 March 1793 and remained until 12 April. They coasted New Guinea and New Zealand, but added nothing of importance to the charts of Australasian waters.

The authorities for this period are Collins, Hunter, Phillip, and Tench, who took part in the work; the charts made by the explorers themselves; and the various editions of sailing directions in and near the time. Contemporary books and periodicals relating to naval subjects have many references to the work, and there is much other miscellaneous literature on the subject. The manuscript journal of William Bradley, 1st lieutenant in the *Sirius*, which is in the Mitchell Library at Sydney, is of primary importance as regards the years 1788-91. Besides the text, it contains views in water-colour of Broken Bay and its branches, and charts of Port Jackson as far as Rose Hill, Broken Bay up to the entrance of Berowra Creek, George's River to Salt-pan Creek, and Norfolk Island.

Bass and Flinders.—When on 25 September 1795 H.M.S. *Reliance* entered Port Jackson, she carried among her officers George Bass as surgeon and Matthew Flinders as one of the midshipmen. A month after their arrival these two began a famous and important series of explorations. Bass had brought out on the deck of the *Reliance* a boat eight feet long, which he called *Tom Thumb*; in this the friends explored Botany Bay with such success that they had another boat built, not much bigger, and in March 1796 set out in it southwards along the coast in search of a rivermouth supposed to lie not far away. During the night of 25 March the Notonectian current carried them beyond Bulli, and a head wind prevented their return; they were therefore compelled to run for the Five Islands (close to Cook's Red Point), near which they were fairly washed ashore by the surf, and their stores thoroughly wetted. Some blacks whom they encountered were inclined to be aggressive; Flinders, to divert them, produced a pair of scissors and persuaded them to have their hair and beards cut, while Bass dried the stores and made the boat ready to resume the voyage. On their way back they encountered bad weather, had all they could do to keep the boat from broaching to, and were glad to make Providential Cove, now known as Wattamolla (Flinders says the native name was Watta Mowlee). On 1 April they examined Port Hacking, previously discovered by and named after Henry Hacking the Sydney pilot; and on the evening of the following day the *Tom Thumb* was secured alongside the *Reliance* in Port Jackson. In June 1796 Bass diverted his energy to an attack on the Blue Mountains, described under EXPLORATION BY LAND. In August 1797 he was sent in a whaleboat to Coalcliff, as already narrated. The news he picked up from the survivors of the *Sydney Cove's* crew led him to ask Hunter for a good boat manned by six seamen

wherewith to investigate the region in which that vessel had been wrecked. Flinders, who had just been promoted lieutenant, was busy on repairs of which the *Reliance* stood greatly in need, so Bass on this occasion went alone. 'On Sunday Dec. 3, 1797 at 6 p.m.' he wrote in his journal, 'we towed out between the Heads. At night we anchored at Little Harbour, for the night looked squally and uncertain and things had not yet found their proper places in the boat.' On 7 December he was near Jervis Bay, where he discovered and named the Shoalhaven; on the 14th in Bateman Bay; on the 19th in Twofold Bay; and on the 20th off Cape Howe. On 1 January 1798 he was in the vicinity of Cook's Point Hicks (which he did not see), and the next day rounded Wilson's Promontory, intending to make Furneaux Islands, replenish his water and obtain mutton-birds for food. But the wind was from the SW., and the boat leaked; he was driven to the westward, and so discovered and entered Western Port. On the return he spent some time examining Wilson's Promontory, and from what he saw came to the conclusion that:—'Whenever it shall be decided that the opening between this and Van Diemen's Land is a strait this rapidity of tide and the long south-west swell that seems to be continually rolling in upon the coast to the westward will then be accounted for.' He arrived in Sydney on 25 February 1798. The whaleboat was preserved for some time; Péron, writing in 1802, says that it was treated with 'religious respect;' but the picture given of it in his Atlas is certainly not a whaleboat—someone may have played a practical joke on him. When the boat fell to pieces, its timbers were made into snuff-boxes and similar curios.

Flinders meanwhile had gone with the *Francis* on her second voyage to the wreck of the *Sydney Cove* (see previous section), and the information he gathered there about the westward-setting tides strengthened his belief that a passage was open in that direction. Talks with Bass confirmed the belief; Hunter was willing to back it; six months later the *Norfolk* (a sloop of 25 tons that had been built at Norfolk Island) was fitted out, and with a crew of eight men Bass and Flinders started on 7 October 1798 to settle the question. They passed Green Cape two days after leaving Sydney, and then made for Twofold Bay, which they surveyed between 9 and 14 October, and reported it as useful for a whaling station. Past Cape Barren Island they sailed through Banks' Strait, and proceeded along the north coast of Tasmania, discovering Port Dalrymple on 3 November. On 3 December they left this port westwards, and on the 8th rounded a headland and saw a swell from the south-west breaking heavily on a reef. This was final: they had passed a strait and come back into open ocean. Rapidly—for the western coast of Tasmania struck Flinders as 'dismal' and 'horrible'—they ran down to South-west Cape, entered the estuary of the Derwent on 21 December, spent ten days in investigating it, and on the 31st set sail again for Sydney, which was reached on 12 January.

On 8 July 1799 Flinders in the *Norfolk* went off to explore Cook's Glasshouse and Hervey Bays (Bass had gone to England). On this voyage Flinders named Shoal Bay, added five islets to Cook's Solitary Group, and named Sugar Loaf Point, Pumice Stone River, and Point Skirmish (after a slight affray with the blacks); also, following Hawkesworth's narrative instead of Cook's chart, he altered the spelling of Morton Island to 'Moreton.' He returned to Sydney on 20 August.

The authorities for this section are the charts for the period, the contemporary narrative in Collins's *Account of New South Wales*, the logs of the boat-voyage and of that in the *Norfolk*, and Flinders's own *Voyage to Terra Australis* with its accompanying atlas. Ernest Scott's *Life of Matthew Flinders* covers the ground very fully, and is well documented.

Grant and the 'Lady Nelson.'—Captain John Schanck, R.N., one of the commissioners of the transport board, who during the American war had given evidence of his skill in constructing small vessels for service on the lakes, in or before 1783 invented sliding keels (centre-boards) and in 1789 demonstrated their utility in the cutter *Trial*. It was then determined that a 60-ton brig, the *Lady Nelson*, should be constructed to test still further the value of the invention. This vessel was in 1799 assigned for work on the Australian coast, and on 16 January 1800 left the Thames in command of Lieutenant James Grant. On her way out she met with bad weather, but behaved well, thoroughly demonstrating that her sliding keel (which was constructed in three parts) did not interfere with her seaworthiness. The brig called at Santiago in Cape Verde group and at Cape Town in South Africa, where Grant received a letter from the Duke of Portland instructing him to make for Sydney via the newly discovered Bass Strait. On 3 December 1800 Grant made his landfall on the South Australian coast, naming on that day two mountains (Schanck and Gambier) and two capes (Northumberland and Banks). Thence he made a careful examination of the coast-line as the *Lady Nelson*—the first vessel to do so from the west—passed through the strait (crossing almost directly from Cape Otway to Wilson's Promontory), and arrived in Sydney on 16 December. On 6 March 1801 King sent the *Lady Nelson* to make a further survey of the bight near Western Port which he had previously left uninvestigated. The *Bee* (a local vessel of about 15 tons, manned by convicts) was ordered to accompany the *Lady Nelson* as a tender; but she was so unseaworthy, and her master and crew so unskilful, that Grant when off Jervis Bay sent her back to Sydney. Francis Barrallier—afterwards well known in land exploration—and George Caley the botanist accompanied Grant, who remained in Jervis Bay from 11 to 13 March, surveying it in boats, and then proceeded to Bass Strait, coasted along from the Promontory to Western Port, stayed there surveying from 21 March to 29 April, and returned to Sydney on 14 May 1801. The *Lady Nelson* was now ordered to convey Lieutenant-colonel Paterson to the Hunter to make a survey there. The *Francis* was to accompany Grant and bring back a cargo of coals; and Dr. Harris, Barrallier, and Lewin the artist were to assist in the survey. On 12 June Grant rounded Nobby's, and on the 26th sent back the *Francis*, loaded with 40 tons of coal and plenty of wood. Grant, Paterson, Barrallier and Harris meanwhile examined the neighbouring country. On the 28th the ship was taken six miles upstream, and the party spent more than three weeks in boat-voyages up various rivers. It is noteworthy that Barrallier considered the main stream to run due N. and S.—on his map what is now the Hunter is treated as a tributary and called the Paterson, while the name 'Hunter' is given to the Williams. On 22 July the *Lady*

Nelson sailed for Sydney, where Grant handed her over to the colonial government and decided to return to Europe.

Grant was succeeded by Lieutenant John Murray, who had been master's mate of the *Porpoise* and acting first mate of the *Lady Nelson* on her trip to Western Port. After a voyage to Norfolk Island he was sent by King (who had never been satisfied with Grant's doings in Bass Strait) to 'prosecute discoveries in those straights on the southwest coast of this country.' His instructions were exceptionally precise: King was determined to have things properly done this time. He was to go first to the Kent group, then to Wilson's Promontory, then to Point Schanck (which seems to have been the western limit of Grant's view), and then to 'trace the coast between Point Schanck and Cape Albany Otway.' King Island must next be investigated, the western end of the strait charted, and the coast west of the Otway examined as far as Cape Banks. Murray left Sydney on 12 November 1801, and began badly by mistaking the Furneaux group for the Kent group, but retrieved his error and by 7 December was in Western Port. Leaving this harbour on 4 January, he ran west along a coast-line obscured by bush fires, but about 3 p.m. 'saw ahead an opening in the land that had the appearance of a good harbour NW. 10 or 12 miles'—the first authenticated sight of Port Phillip by a white man. Fearful of being driven on a lee shore, he stood away towards the Otway, ran down to King Island, spent the rest of January making a careful survey of it, and on the 30th, while trying to reach the Otway again, was driven back to Western Port. On the 31st he sent off the ship's launch under Bowen to look at the new harbour westwards; it returned on the 4th with the news that the entrance was good, about 1½ miles across, that within it was '*a most noble sheet of water*,' and that the boat's crew had lived on swans all the time they were away. On the 14th, therefore, Murray took the *Lady Nelson* in through the heads and anchored somewhere near Sorrento. His enthusiasm about the beauty of the shore led him to compare it first to Greenwich Park, then to Blackheath; 'the hills and valleys' he wrote in his log, 'rise and fall with inexpressible elegance.' No wonder Collins a year or two later was disappointed with the actual country. On the 16th the crew had a brush with the natives; no harm was done, but the natives were scared away, and no information was procured from them. On the 21st the launch discovered and explored Corio Bay: on 5 March the South Channel was found after much hunting: on the 8th at 8 a.m. Murray hoisted the Union Jack on shore and at 1 p.m. took formal possession of the country for England. On the 11th he passed the heads outwards in 'such a ripple that we expected every minute it would break on board'—the first mention of the Rip—and on the afternoon of the 23rd was back in Port Jackson.

The original authorities for this period are the logbooks of Grant and Murray, and the charts of the latter officer preserved in the admiralty's library. These documents have been fully used and are largely quoted by Ida Lee in her *Logbooks of the 'Lady Nelson.'* Grant's *Narrative* of the ship's voyages while under his command is also worth study.

Flinders.—When the *Reliance* reached England, the charts of the discoveries mentioned under *Bass and Flinders* above were published, and a plan was proposed by Sir Joseph Banks for completing the examination of the Australian coast. The *Xenophon*, a sloop of 334 tons, was chosen for the work; her name was changed to *Investigator*, and Flinders, promoted commander on 25 January 1801, was given charge of her on 16 February. He was supplied with a long letter of 'Instructions' and a passport in French setting forth the peaceful mission of his ship, in case he should fall in with French warships. Among the ship's company were John Crossley (astronomer), Robert Brown (naturalist), Ferdinand Bauer (natural history painter), and William Westall (landscape painter). Crossley left the ship at the Cape of Good Hope on account of illness, and Flinders, his brother Samuel (the second lieutenant), and John Thistle the master were principally responsible for the scientific work. On 6 December 1801 the ship was off the Leeuwin, and Flinders began a thorough survey from that point onwards, of a coast-line only before known imperfectly by the vague discoveries of Nuyts, Vancouver, and D'Entrecasteaux. Grant in the *Lady Nelson* had discovered a part of it in 1800 on his way to Port Jackson, but of this Flinders was unaware when he was on the coast.

On the 7th Flinders fixed the position of the Leeuwin, and from the 8th to 5 January 1802 was in King George's Sound. He next passed through the Recherche Archipelago, sighting 45 islands in the group. Eight years earlier D'Entrecasteaux had been in these waters, and to that navigator Flinders gave full credit for his discoveries, leaving unaltered names that he had given, though often correcting their positions. The Frenchmen had stood away after passing the islands of St. Peter and St. Francis at the extremity of Nuyts' Land, and from there Flinders was on a practically unknown coast-line. On the night of 26 January he crossed the meridian that now forms the western boundary of South Australia, and work in Nuyts' Archipelago, the Investigator group, and along the coast as far as Cape Catastrophe, filled the period from that date till 20 February. On the night of 21 February John Thistle was drowned; he had been with Flinders in the *Norfolk*, and before that with Bass in the whaleboat, and his loss was deeply felt by his commander. The *Investigator* was now just within Spencer Gulf, where—because of an unusually strong tide-set from the north, whither also the lie of the land was—Flinders hoped to find some passage through to the Arafura Sea. After a thorough survey of Port Lincoln he on 6 March started hopefully up the gulf; but it narrowed and shoaled steadily, and on the 11th he took to a boat, made sure that there was nothing north of him but mangrove swamps, and reluctantly gave up his illusion. Working slowly down the eastern coast, he passed Cape Spencer on the 20th, coasted along Kangaroo Island to the eastern side of Nepean Bay, worked back and forth across Investigator Strait and up into St. Vincent Gulf (the head of which he reached in a boat on the 30th), came back to Nepean Bay—where he was greatly interested in the abundant fauna, emus, kangaroos, pelicans, seals—and on 7 April traversed Backstairs Passage to meet next day a strange sail. He knew before he left England that the French government had sent an exploring expedition to Australian waters, and surmised rightly that this was one of their vessels; it was, in fact, Baudin's *Le Géographe*, whose story will be found under EXPLORATION, FRENCH. After friendly conversations the two explorers parted

company, and Flinders on the 27th passed Cape Banks. At this point we may note his extreme punctiliousness in the matter of nomenclature. He bestowed names freely wherever he believed himself the first discoverer; where anyone had preceded him, he insisted on the retention of the first-given name, were it Dutch or French or English. Thus from the Leeuwin to Encounter Bay (where he met Baudin) all the names are his own except what few the Dutch had given long before and two patches of French names —one near the Leeuwin itself, the other on Kangaroo Island—that were rightfully D'Entrecasteaux's or Baudin's. From the Bay to Cape Banks also Baudin was undoubtedly first, and his names remain on the map to-day; east of Cape Banks—where Baudin scattered French names profusely, naming the whole country from Wilson's Promontory to Streaky Bay 'Terre Napoléon,' just as he complacently renamed the very gulfs from which Flinders had just come —Flinders abode by the nomenclature of Grant and Murray and Bass, adding a few names of his own, but never altering those already given. The fact that a few of Murray's names in Port Phillip were replaced by those of Flinders is due to the fact that Murray's charts were lost for many years.

On 21 April Flinders found himself under the lee of King Island, and on the 26th ran across to Cape Schanck and bore up towards the entrance of Port Phillip, which he at first took for Western Port. Next day he discovered his mistake, and began to examine the country; but the mass of shallows that lies just inside the mouth of the bay, and is now evaded by keeping well along the southern shore, puzzled and hindered him, and (except for a visit to Station Peak beyond Corio Bay) he did little but unconsciously duplicate Murray's work. On 3 May he left the bay, and on 9 May was in Port Jackson. On 21 July he sailed again, in company with Murray in the *Lady Nelson*, to make a more careful examination of the coastline Cook had charted, and to survey Torres Straits and the western side of the Cape York peninsula. Against the skill of Flinders Murray's zealous amateurishness showed badly, and on 18 October he was sent back to Sydney. Meanwhile they had discovered the two best harbours on the north-eastern coast, Port Curtis and Port Bowen (now known as Port Denison, with the town of Bowen on it). Soon after the last of these discoveries Flinders threaded his way through the Barrier Reef by Flinders Passage, the most southerly of those now used, and on 28 October was in the mouth of Torres Straits. On 3 November he entered the Gulf of Carpentaria, careened his ship, and to his great disappointment found her in very bad condition; she was quite unfit to stand a storm, but with continued fine weather might last six months. This made return through the straits too dangerous to be contemplated, and Flinders determined to continue his work in the Gulf, where mild weather might be expected, and then to run for Sydney clean round Australia with possibly following winds. On the eastern side of the Gulf he identified as well as he could (but unfortunately with many inaccuracies) the rivers laid down from Carstensz's survey on Tasman's chart; along the western side he put in three months of assiduous investigation; and on 18 February, when among the English Company's Islands off the NE. corner of Arnhem Land, fell in with a flotilla of praus from Macassar that were searching for bêche-de-mer, and gave them the first news the Malay princes ever received of the occupation of Australia by the English. Then, making hastily for Koepang in Timor to make what minor repairs he could, he left again on 12 April and ran west-about past the Leeuwin to Port Jackson, which he reached on 9 June after an absence of 10 months and 19 days. The *Investigator* never explored again. Used as a storeship in Port Jackson till 1805, she was thought sound enough in that year to make the voyage to England; but, when she at last reached Plymouth in a 'deplorably crazy' state, she was condemned at once and in 1810 broken up.

Flinders, however, was not to be put off his life's work by a ship's unseaworthiness. King offered him any of the vessels lying in the harbour, but none was sound enough for rough usage. It was finally decided that the *Porpoise* should be sent to England 'by the route Captain Flinders may indicate,' so that, without incurring the great expense of fitting up a doubtful vessel for special work, Flinders might carry out some explorations on the way home and then return to Australia in a seaworthy ship. The *Porpoise* left Port Jackson on 10 August 1803, taking by Flinders's orders the route via Torres Straits; on the 17th she went ashore on Wreck Reef, which lies in open ocean about 740 miles NNE. of Sydney. Two merchant vessels were with her; one was wrecked a little way off, the other deliberately deserted the wrecked ships and went on to Batavia and India—and on her way from India to England disappeared, and was never heard of again. Flinders made a camp on the reef, organized the refugees, and on the 26th started back to Sydney in a ship's cutter, regaining Port Jackson on 8 September —no mean feat of navigation. Just six weeks from the day he left he was back again with three rescue vessels—one, the old *Francis*, to take to Sydney those who wished to return there; one, the *Rolla*, bound for China (in her went the younger Flinders and John Franklin); one, the *Cumberland*, a 29-ton schooner that had been built some years earlier in Australia, to take Flinders himself and ten picked men to England as directly as possible. This vessel was leaky and deficient in storage-room, so that Flinders was compelled to put into port oftener than he wished. He filled up and did some repairs at Koepang, and then tried to make the Cape of Good Hope direct, but met a heavy swell 23 days out, took in more water than he dared neglect (he had only one pump in working order), and was forced to run for the Mauritius. This was possibly an enemy colony; he had left England in peace-time, but everyone knew then that war was imminent; the *Investigator*, however, like most vessels engaged in scientific expeditions at that time, had a passport ensuring her safety from hostile attack, and Flinders trusted that his would serve for any peaceful vessel that he might command. On 15 December 1803 he entered a small port in the south-west of the island; he left it on 13 June 1810. The full story of his captivity, and the reasons—some of them mere misunderstanding, some of real weight in wartime—which induced Decaen, governor of the Mauritius, to detain a peaceful explorer engaged in purely scientific work, are set forth in great detail in Scott's *Life of Matthew Flinders*, and may be studied there; suffice it to say here that the detention was not the mere brutal act of tyranny that is so often depicted, and that the charge (even more frequently made) that advantage was taken of

Flinders's position to steal his charts and publish them in Paris as showing French discoveries has been completely disproved.

Set free in June 1810 and given a passage via the Cape to England, Flinders reached London on 23 October and at once set to work to prepare his charts and logs for publication. One evil his long detention had wrought; it had given Péron and Freycinet, the geographers of Baudin's expedition, a chance of publishing their results first; and, as they had skirted the same coasts between Bass Strait and the Leeuwin, and had (as already mentioned) renamed every feature they noted without the slightest regard for the work of previous explorers, the prior publication of their book and atlas both irritated and injured Flinders. He worked incessantly and with extreme care, in spite of the recurrence of a constitutional trouble which aged him so that at 39 he looked like 70. On 18 July 1814 the first copy of *A Voyage to Terra Australis* was sent to his house, but he was already unconscious; on the 19th he died.

The story of his detention, release, later work and death does not properly belong to the records of exploration. But Flinders was too great and too unfortunate to be left at a loose end; his story had to be completed when once begun.

Phillip Parker King.—Between Flinders and King there was no serious attempt to explore the coast; occasionally merchant vessels reported patches of reef, and some surveying was done by Lieutenant Charles Jeffreys in H.M. brig *Kangaroo* near Newcastle and in Tasmania. Flinders had left practically untouched the coast-line west-about from Arnhem Land to the Leeuwin, but a good deal was known as far north as Shark Bay; in 1817, therefore, Lieutenant Phillip P. King (q.v.) was instructed by the admiralty to proceed to Sydney and complete the survey, Macquarie being asked to supply him with a small vessel suitable for the service. The *Mermaid* (a cutter of 84 tons burthen) arrived from India just after King landed, and was purchased for £2000. Her complement of 19 included Allan Cunningham the botanist and Bongarie, the aboriginal who had been with Flinders. She left Sydney on 22 December 1817. It was decided to begin the survey at North-west Cape, and to proceed there via King George's Sound, which was reached on 20 January 1818. In spite of several accidents during the first month of his surveying, King managed to accomplish a good deal of useful work: he examined 'the great bay of Van Dieman,' corrected the observations of Dampier and Baudin, fixed the position of the Imperieuse and other shoals, added many new discoveries, some of major importance, to the chart, and returned to Sydney to refresh on 29 July 1818. The construction of the charts of this voyage (which represented 500 miles of coast surveyed) occupied him in Sydney until December 1818, after which he decided to make a survey of Macquarie Harbour, then lately discovered. The *Mermaid* sailed on 24 December, and on the way King noted that Cook's 'Red Point' really consisted of five islands and that the natives called the district Illawarra. On 10 January 1819 the *Mermaid* left Hobart, passed through D'Entrecasteaux Channel (then 'improperly called by the colonists Storm Bay Passage'), was in Outer Bay on the 17th, buoyed Kelly's Channel, chartered Macquarie Harbour, and on 29 January was back in Hobart. On 8 May she sailed from Sydney for Torres Straits via Port Macquarie, accompanied by Oxley in the *Lady Nelson* bound to examine Port Macquarie. King was at Port Macquarie on 10 May and with Oxley examined Camden Haven and the Hastings, noting the abundance of 'what the colonists call the Swamp Oak;' on 21 May the *Lady Nelson* returned to Sydney. The *Mermaid* was off Mount Warning on 23 May, and King felt sure from what he saw that there must be a big river-mouth in the neighbourhood; Oxley in 1823 discovered the river, and named it the Tweed. On his way up the coast and through Torres Straits King made numerous additions to the discoveries of Cook, Flinders, and the Dutch and French explorers. At the Endeavour River he found the local native tribes unfriendly—an experience which Cook had had, and which King was to repeat in an aggravated form two years later. Near the western head of Bathurst Bay he found the deserted wreck of the *Frederick*, which had sailed from Sydney early in 1818—one of the long list of shipwrecks that was to mark this dangerous passage for years to come. Passing Torres Straits and crossing the Gulf, he resumed his survey of the north coast at the Wessel Islands, discovered the Liverpool River, crossed Van Diemen's Gulf, and passed the entrance to Port Darwin without thinking it worth investigation, but made a thorough examination of Cambridge Gulf. By the middle of October, when he was in Admiralty Gulf, he felt the necessity for refreshing his crew, made for Savu in the Malays, and anchored there on the 24th; the next day he sailed for Koepang, and reached Sydney west-about on 12 December, having surveyed 540 miles of coast. On 13 July 1820 he sailed again, and on 14 August found a board on Booby Island narrating the safe passage so far of the *Sea-Flower*—a vessel that left Sydney on 21 May, took the outer passage, and entered Torres Straits past Murray Island after a 21 days' passage; this showed that merchant ships were already beginning to take the outer route with confidence. On 6 September at Montague Sound the survey was commenced again, but on the 20th the cutter began to leak badly. They managed to reach Brunswick Bay; there, as they had already lost two anchors, the weather was bad, and the crew began to grow sickly, it was decided to return to Sydney for a thorough overhaul and the *Mermaid* reached port on 6 December 1820.

The *Mermaid* was now surveyed, and condemned for this particular service, but was subsequently repaired and served in New South Wales waters for years. A teak-built brig of 170 tons was purchased and renamed the *Bathurst;* the total complement was increased to 33, and they were now able to carry a long-boat—a resource they had not possessed in the *Mermaid.* The *Bathurst* sailed on 26 May 1821. In Bathurst Bay they had disquieting encounters with the natives, and on Clack Island, not far away, Cunningham discovered a remarkable aboriginal picture-gallery. The survey began again at Brunswick Bay; Hanover Bay and King Sound were thoroughly examined, and the coast-line charted with great exactness to a little west of Roebuck Bay. Thence King made for the Mauritius, refitted, made back to King George's Sound, recommenced his survey at Rottnest Island near Fremantle, and thence worked northwards round North-west Cape to King Sound. On 20 February 1822, finding himself short of provisions, with only one anchor left, and threatened with a spell of

stormy weather, King decided to end his work and make back to Port Jackson. On 15 April he was in Bass Strait; on the 25th he reached Sydney, to find that he was to take the *Bathurst* to England 'when the survey should be completed.' As nothing more could be done on the north-west coast until the following year, he decided to go to England at once. On 25 September he sailed: on 6 October he was south of Tasmania, correcting Flinders's charts (which here were unusually inaccurate); thence he made his way via King George's Sound, Simon's Bay and St. Helena to Plymouth, which he reached on 23 April 1823.

The 'Beagle'.—The next serious attempt to survey the coast of Australia was begun in 1837. From 1826 to 1836 P. P. King was employed by the admiralty on a survey of the coast of South America with the *Adventure* and *Beagle*, and during his term had under him in the *Beagle* Captain Fitzroy (afterwards governor of New Zealand) as commander (1828-36), Owen Stanley as a midshipman (1831-6), Conrad Martens as artist (1832-4), and Charles Darwin as naturalist (1831-6). Australia was visited, and Darwin recorded the visit in his *Voyage of the 'Beagle,'* but no explorations were made here. In 1837, however, the *Beagle* was recommissioned under Captain J. C. Wickham for the survey of Bass and Torres Straits and of that part of the north-western coast which Flinders and King had either neglected or treated sketchily. George Grey and Franklin Lushington embarked with Wickham, but left the ship at Cape Town to hire a schooner and make for Hanover Bay, where they began the journey described under EXPLORATION BY LAND. The *Beagle* reached the Swan River on 1 November 1837, and Wickham, after resurveying Roebuck Bay (Jan. 16-22) and the outer part of King Sound (Jan. 27 to Feb. 23), took up King's interrupted work at Disaster Bay and on the 26th discovered and named the Fitzroy River. Working northwards along the coast, on 15 April he met Grey's party near Hanover Bay, and then made his way back to Swan River and so to Hobart and Sydney (24 July), whence on 11 November the *Beagle* sailed to survey Bass Strait.

On 22 May 1839 Wickham sailed again for the north-west, running up the coast of New South Wales and commencing his discoveries with an island off Cape Capricorn. Having in 1838 fraternized in Port Jackson with the expedition under Bremer and Owen Stanley that was to make a settlement at Port Essington, he made straight for that port and, during investigations in neighbouring waters, discovered on 27 July the Adelaide River; but the real work of this cruise was done after leaving Port Essington on 4 September, and included the discovery and charting of Port Darwin and Bynoe harbour (9 to 26 September) and of the Victoria River (17 October to 12 December). The year 1840 was occupied with resurveys of areas on the west coast, at King George's Sound, and in Bass Strait, and it was not till the end of May 1841 that the *Beagle* (now under Captain Lort Stokes, Wickham having been invalided to England) left Port Jackson for another cruise of exploration. This time she doubled into the Gulf of Carpentaria, surveyed its southern end, and discovered the Flinders (28 July) and Albert (1 August) rivers, and on the latter an area of rich land which Stokes called the 'Plains of Promise.' The rest of her term in Australian waters (which lasted until 6 May 1843) was devoted to surveys of areas that were already roughly known; these, like the subsequent work of the *Fly* (1842-5), the *Rattlesnake* (1847-50), and the *Basilisk* (1871-4) hardly come under the heading of exploration.

W. J.

Eyre, EDWARD JOHN (1815-1901), born at Hornsea in Yorkshire on 5 August 1815 and educated at Louth and Sedbergh, was intended for the army, but at the age of 17 found that he must wait yet longer for a commission and impatiently took the purchase-money, migrated to Sydney, and busied himself in droving cattle and sheep to the new settlements on and beyond the Murray. In 1837 he conceived the idea of taking stock across country to the just-founded settlement at Adelaide, which was then reached only by sea; and, organizing his party on the upper Murray and obtaining supplies from Port Phillip, he on 9 February 1838 started west past Castlemaine and across the Loddon to the Wimmera, which he followed to Lake Hindmarsh. Here he found himself in thick waterless scrub, and was forced to return to the Loddon, follow it to the Murray, and make for Adelaide by a track along that river already pioneered by Joseph Hawdon. In 1839 he made two expeditions, one from Adelaide to Mount Arden north of Spencer Gulf (during which he sighted Lake Torrens), the other from Port Lincoln to and beyond Streaky Bay and back to Mount Arden. Having found himself almost continuously in barren and waterless country, he came to the conclusion that it was useless to attempt the discovery of a stock route westwards, and that the only field for explorers lay to the north. Accordingly—after a short visit to Western Australia early in 1840, during which he drove stock from Albany to Perth—he on 18 June 1840 left Adelaide with an expedition intended to penetrate the unknown region east of Lake Torrens. After two attempts—in one of which he reached Mount Deception, in the other Mount Hopeless—he abandoned the northern route, sent his party across to Streaky Bay, obtained fresh stores from Adelaide via Port Lincoln, moved the expedition as far as Fowler's Bay, and made several attempts to take it farther westwards. In January 1841 he determined to send the expedition back to Adelaide and try to force a way through to King George's Sound with packhorses only. Starting on 25 February, accompanied only by one white man (Baxter) and three blackfellows, he spent two months in skirting the Bight, here bordered by a plateau entirely destitute of water; on the evening of 29 April two of the natives murdered Baxter and stole most of the stores; and for another month Eyre and one blackfellow (a native of King George's Sound) continued their desperate journey until on 2 June they found a French whaler lying in Thistle Cove, a little E. of Esperance. Replenishing their stores from this friendly vessel, the travellers reached Albany on 7 July, and by the 26th Eyre was back in Adelaide.

From October 1841 to November 1844 Eyre was resident magistrate and protector of aborigines in the Murray district of South Australia, and proved himself one of the kindliest and most judicious officers ever placed in contact with the wild native tribes. In 1844 he twice offered to lead an expedition from Moreton Bay to Port Essington; but Gipps considered that Sir T. Mitchell had the prior right to this exploration, and Eyre in 1845 went back to England for his health's sake. There he

published his *Journals of Expeditions of Discovery*, in which he included a long and valuable study of aboriginal habits that has not yet lost its value. His subsequent career had no connection with Australia. From 1846 to 1853 he was lieutenant-governor of New Zealand under his friend Sir George Grey, in 1854-60 governor of St. Vincent in the West Indies, in 1860-1 acting governor of the Leeward Islands; in 1861 he became acting governor of Jamaica, and in 1864 received the permanent appointment. There in the following year he was confronted with a serious negro mutiny, promptly suppressed it, and in so doing irregularly hanged a negro member of the local legislature who was undoubtedly an agitator among the mutineers. The ensuing scandal caused his reprimand and recall; but in England an outcry against him led by John Stuart Mill, T. H. Huxley, and Herbert Spencer was counter-balanced by a body of supporters among whom Carlyle, Tennyson, and Ruskin were prominent, and the final result of much agitation and two legal trials was that in July 1872 the Gladstone ministry, with the approval of parliament, paid his legal expenses from public funds. In 1874 Disraeli allotted him the pension due to a retired colonial governor, and he lived in seclusion from that time until his death on 30 November 1901.

Eyre, JOHN. See ART.

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agus. See NOTHOFAGUS.

Fairfax, JOHN (1804-1877), born at Warwick in England in 1804, was at the age of 12 apprenticed to a local printer and afterwards worked on the *Morning Chronicle*. In 1825 he settled at Leamington as a printer, and published a small newspaper, the *Leamington Spa Chronicle;* but an action for libel brought against him by a town official, although he won it, ruined him commercially, and he migrated to Australia in 1838, reaching Port Jackson in the *Palmyra* on 26 September. On 1 April 1839 he obtained an appointment as librarian to the Sydney subscription library (which afterwards became the public library of New South Wales). Shortly after this he was engaged by F. M. Stokes of the *Sydney Herald* to set up type and do other work after office hours, and proved so valuable an assistant that the management of the paper was gradually transferred to his hands. On 2 September 1840 the *Herald* began its daily issue; on 8 February 1841 it passed into the possession of John Fairfax and Charles Kemp (a reporter on the staff), and on 1 August 1842 appeared for the first time as the *Sydney Morning Herald*. Fairfax had in February 1841 resigned his position at the library, and thenceforth devoted himself to the management of the paper, of which in 1853 he became sole proprietor. In 1857 he took in his sons as partners. Outside his office he was a prominent and useful citizen, and took a large part in establishing the Australian Mutual Provident Society on a firm basis. In 1871 he was appointed to the council of education, and in 1874 was nominated to the legislative council. He died at Sydney on 16 June 1877.—His second son, SIR JAMES READING FAIRFAX (1834-1919), born at Leamington on 17 October 1834 and educated at Parramatta and Sydney under Dr. Woolls and Henry Cary, was at the age of 17 given employment in his father's office, taken into partnership in 1857, and in 1888 took over the active management of the paper. Like his father, he devoted his life to the *Herald*; but he was also a founder and high official of the national art gallery, the Prince Alfred hospital, the royal naval house, the national rifle association, the boys' brigade, and the Y.M.C.A., a director of two banks and several business firms, vice-president of several musical societies, and commodore of the royal yacht squadron. He died at Sydney on 28 March 1919.

Falcon. See HAWKS.

Fantails. See FLYCATCHERS.

Farming. See AGRICULTURE.

Farrell, JOHN (1851-1904), was born on 18 January 1851 at Buenos Aires in South America, brought by his parents to Victoria at the end of 1852, reared on his father's farm near Maldon on the Victorian Loddon, and privately educated. In 1870 he began work at a brewery in Bendigo, and for the next 17 years was mainly employed in that trade, with short intervals during which he tried gold-mining in northern Queensland (1873-4) and farming at Benalla (1876-7). In 1887, when he was part-owner of a brewery at Queanbeyan, he determined to abandon the trade altogether and take to journalism.

From 1876 onwards he had been writing occasional verse and prose for local newspapers, and in 1882 became a contributor to the *Bulletin*. His best-known poem, 'How He Died'—which was read and approved by Tennyson—appeared in that journal on 21 July 1883, and his first book of verse (named after the poem) in January 1887. Between those dates—at some time in 1884—he had read and delighted in Henry George's *Progress and Poverty*; and the double thread of authorship and political enthusiasm drew him from trade to letters. He bought a newspaper circulating in the Lithgow district, made it a literary success but a financial failure, obtained the editorship of a 'single tax' journal that was published first at Lithgow and then in Sydney, and finally settled down as leader-writer to the Sydney *Daily Telegraph*. This post he occupied from February 1890 to June 1903, with an interval (June-September 1890) during which he was editor of the paper. Journalism, however, was almost fatal to verse; after 1887 he wrote very little, though his two best poems belong to the later period—'Australia,' a fine piece of eloquence written for the *Picturesque Atlas of Australasia* in 1888, and 'Ave Imperatrix' (afterwards published as *Australia to England*), written for the diamond jubilee of Queen Victoria, which was not only Farrell's but the Empire's high-water mark in patriotic verse. His health had for many years been bad—not because of his trade, for it is hard to believe that any other brewer ever made so little use of his own goods; and at the end of 1903, possibly because the strain of incessant active work had been removed, he broke down altogether. He died in hospital of heart failure on 8 January 1904. See LITERATURE.

Farrer, WILLIAM JAMES (1845-1906), son of a Westmoreland landowner, was born on 3 April 1845, educated at Christ's Hospital and Pembroke College, Cambridge (B.A., 1868; wrangler), and studied for the medical profession, but abandoned this intention on account of ill-health and migrated to Australia in 1870. Here he worked at first as tutor in the family of the Campbells of Duntroon, then (losses in mining speculations having swallowed up the capital with which he had hoped to purchase a sheep-station) as a surveyor; in 1875 he entered the New South Wales department of lands as a contract surveyor, and worked in the Dubbo, Cobar, and Cooma districts until 1886. In that

year he resigned, and settled at Lambrigg near Queanbeyan, where he commenced to experiment in hybridizing wheats with the object of finding rust-resisting or rust-proof varieties. The annual loss from rust in Australian wheat was at that time estimated at £2,500,000. For the next 11 years Farrer pursued his experiments steadily at his own farm, developing his researches so as to include the improvement of the milling value of wheats; for this purpose he invited and received the ungrudging help of F. B. Guthrie, chemist to the department of agriculture, who had specialized in this subject. In 1898 Farrer was made wheat experimentalist to the department of agriculture; this enabled him to command more help and a greater variety of soils and climates for testing purposes, and gave him, for growing his seed-wheat, areas sufficiently large to let him distribute it to farmers for general cultivation. Eight years, however, of hard and constant work wore him down; early in 1906 he began to acknowledge overstrain, and on 16 April in that year he died.

In the pursuance of his objective—the improvement of wheat so as to get the best results under Australian conditions—Farrer was driven to produce a large number of varieties, each with characteristics suitable to encounter some or all of the exceedingly diversified conditions imposed by the very various Australian soils and climates. He had not only to press upon his creations powers of resistance to rust, or of resistance to or immunity from smut and bunt, but to provide wheats suitable to the coastal districts and tablelands as well as to the semi-arid western areas; wheats specially adapted for hay as well as 'dual-purpose' wheats (which enable the farmer either to allow his grain to ripen, or in the case of adverse seasons to save it by cutting it for green feed or hay); wheats with short stiff straw, enabling the crop to resist wind-storms; wheats which mature early or late or in mid-season; wheats which hold their grain well and thus escape the serious loss by shelling that was common with many of the older varieties; wheats of high gluten content, and consequently of great nutritive value; above all, wheats of high milling excellence and greater commercial value than were the varieties previously in cultivation in Australia. He never allowed a variety to be distributed unless he was sure that it could produce a flour of high quality.

Of the actual value of his work to Australia it is difficult to speak highly enough. Few men have so persistently fought their way through against such discouragements and embarrassments as fell to his share; fewer still have won so lasting a triumph, have so fully achieved their desires, and given their country so great and permanent a gift. The work he undertook was colossal; for the making of any given strain scores of crosses had to be prepared (he actually made from 200 to 400 annually), the grain from each plant had to be sown separately, and the result of a whole year's toil might be only a few grains from one ear. His best-known creation—'Federation' wheat—transformed growing conditions in New South Wales, Victoria, and South Australia, and his 'Florence' is doing the same for Queensland; with them he made it possible to extend the area under cultivation into districts previously considered quite unsuitable for wheat. The increase in the average acre-yield of grain due to the general use of these wheats has been estimated at about two bushels; as the average acre-yield in New South Wales is about 12 bushels, this represents an increase of over 16 per cent on the total harvest. Moreover, the increase in the value of Australian wheat in the world's markets due to Farrer's work has been estimated at 2s. a quarter at least.

And the lesson has been learnt. Of the many strains generally cultivated prior to 1900 not more than two or three are now grown to any extent; the rest have been replaced either by Farrer wheats or by strains bred from them. And, if his products are nowadays not so outstanding as in 1906, but have their place among other greatly improved varieties, it is largely because his efforts and success encouraged other experimenters. In 1904 British experts were still asserting that 30 years of cross-breeding had failed to produce a single marketable variety, and were warning agriculturists against expecting practical results from 'these abstruse experiments in cross-fertilization.' Even then Farrer had disproved their words; since then his reputation has become world-wide, and his example has filled the laboratories of Britain and the United States with emulative followers.

Soon after his death it was decided to commemorate his work by raising a fund out of which the expense of further researches should be met. Although the response was disappointing—even discreditable—enough was obtained after some years to institute a Farrer research scholarship; in 1920-22 the first scholar studied in Britain and America, and in 1923-4 the second investigated the root development of wheat and similar subjects at Sydney and at the Wagga experimental farm.

Faucett, PETER (1821-1894), born in Dublin and educated at Trinity College (B.A., 1842), was called to the Irish bar in 1845, migrated to New South Wales in 1852, was admitted to the local bar, and in 1856 entered politics as member of the legislative assembly for King and Georgiana. This seat he held till 1859; in 1860 he was member for East Sydney; and from 1861 to 1865 he represented Yass Plains, being solicitor-general in the first Martin ministry from October 1863 to February 1865. In October of the latter year he left politics to become a judge of the supreme court, in which capacity he acquired a reputation for painstaking accuracy. In February 1888 he retired from the bench, and in April was nominated to the legislative council. From 1859 until his death he was a fellow of the senate of the university of Sydney. He died on 22 May 1894.

Favenc, ERNEST (1845-1908), born in London on 21 October 1845 and educated at Berlin and Crowley, migrated to Sydney in 1863 and, after a short experience of commercial life, spent many years in opening up new pastoral country and droving cattle in northern Queensland. In 1878 he was chosen leader of an expedition sent out by the *Queenslander* newspaper to explore unknown districts lying between the Barcoo River and the overland telegraph line through central Australia, as there was talk of constructing a railway line in that direction; an account of this journey will be found under EXPLORATION BY LAND. In subsequent journeys he (*a*) in 1882-3 mapped the upper courses of the Gulf rivers of western Queensland, and traversed the region between the Macarthur River and Daly Waters on the telegraph line, and (*b*) in 1889 investigated the upper Gascoyne and Ashburton. Favenc, who

did a good deal of journalistic work, published a small volume of verse and several collections of tales; but his chief book is *The History of Australian Exploration, 1788-1888*, published in 1888 at the expense of the New South Wales government, and still a standard work on the subject. He also published in 1908 a shorter account of *Explorers of Australia*. He died on 14 December 1908.

Fawkner, John Pascoe (1792-1869), born in London on 20 October 1792, was ten years old when his father was convicted of receiving stolen goods and sentenced to transportation. The family was allowed to accompany the father in the *Calcutta* (one of the vessels sent with David Collins, q.v., in 1803 to establish a settlement on Port Phillip), and went on with him in the *Ocean* to Hobart. Here the elder Fawkner was emancipated and allowed to settle on a 50-acre block in the Glenorchy district, where he throve moderately. His wife went back to England in 1806 as lady's maid to an officer's wife—a fact which may account for the vagrant life into which young John Fawkner thenceforward fell—but in later years returned to Tasmania and died there in 1825. The lad worked in the bush as a sawyer; in 1814 he aided the escape of some Portuguese convicts, was caught, and was deported to New South Wales 'to break the chain of a very dangerous connection which he has formed in the settlement:' returning to Hobart in 1817, he farmed land near his father, made a failure of it, tried baking and timber-selling, shifted to Launceston in 1819, there tried baking and timber-selling again, and gradually added to these activities those of butchering, bookselling (with a circulating library attached), nursery-gardening, coach-owning, and giving lessons in French. In 1824 he built and began management of the Cornwall Hotel, and in 1829 founded and edited the *Launceston Advertiser*. This, the first newspaper published in Launceston, reflected its owner's bitterness against nearly all authority, and he soon lost his hotel licence for libelling the local magistrates and was compelled to part with the newspaper. By making a public apology he was reinstated in the hotel, and for the next few years practised as an advocate in the lower courts of justice. By 1835 he had established a reputation as a fearless and vindictive fighter, and was one of Launceston's most influential citizens.

According to his own story he made plans early in 1835 to establish a small settlement on Western Port, and chartered in Sydney a vessel of 55 tons, the *Enterprise*, to take his assistants across the strait. While he was impatiently awaiting the vessel's arrival in the Tamar, John Batman (q.v.) on 11 June appeared in Launceston with the story of his great purchase of good grazing country on Port Phillip. Fawkner left in the *Enterprise* on 29 June, but seasickness forced him back to land; his party sailed without him to Western Port, found it unsuitable for settlement, moved into Port Phillip and, skirting the eastern shore of the bay, on 20 August anchored in Hobson's Bay. After a vain exploration of the Saltwater River they worked up the Yarra to the falls that then marked the head of tide-water, and on 31 August began building huts to mark a permanent occupation. On this occupation—at which he was not present, and which, as far as the evidence goes, he had neither intended nor anticipated—Fawkner afterwards based a claim to be considered the founder of the colony of Victoria. Lonsdale, writing as administrator of the settlement in 1837, thought otherwise:—

> The site of the present settlement had been previously chosen by Mr. Batman, but Mr. Fawkner, becoming aware of his plans, hastened to commence operations there and took the other by surprise whilst he was engaged in another part of the Bay.

While, however, Batman's claims to priority in settling Port Phillip definitely (ignoring, that is, the earlier failure of Collins) out-weigh those of Fawkner, it was to Fawkner rather than to Batman that the rise of Melbourne itself was due. Batman's association was one of pastoralists, more concerned with areas fit for sheep-runs than with the commercial activities of a town; and the official division, which in effect allotted to the association lands west of Geelong and to Fawkner's party town-sites on the Yarra, was on the whole a fair and satisfactory division.

Fawkner himself landed on Yarra bank on 10 October and before the end of the year had opened what is described by H. G. Turner as 'a general store and grog-shop.' While during 1836 Batman still took the lead in public affairs, Fawkner was steadily consolidating his position; the grog-shop became a hotel at which a lieutenant-governor's wife could stay; on 1 January 1838 appeared the first issue of the *Melbourne Advertiser*, a manuscript newspaper that ran through nine weekly issues; the tenth was printed, and the paper was immediately suppressed as not complying with the colonial press law. Nothing daunted, Fawkner on 6 February 1839 issued the first number of the *Port Phillip Patriot*, which from 4 July onwards appeared twice a week, and lasted till 1843. On 22 November 1840 he issued for the first time the *Geelong Advertiser*, which still exists. In December 1842 he was elected to the first town council, but behaved so vehemently there that he was ejected in 1843. As he grew older, however, his violence moderated, and he was recognized as an eccentric but effective leader in the community. In 1851 he was appointed to the goldfield discovery committee and elected a member of the first legislative council; in 1854 he even took the constitutional side in the disputes after the Eureka riots; in 1856 he was elected to the new legislative council, and held his seat till a short time before his death, which occurred on 4 September 1869. During these later years, though a bitter opponent (as always) of the squatting interests, he was otherwise a conservative, deprecating the introduction of the ballot and the reduction of the property qualification for council members and electors.

Featherwood. See Polyosma.

Federal Capital, The. See Canberra.

Federation. The early history of Australia is a record of separation. The first colony, New South Wales, when founded in 1788 comprised the whole continent east of the 135th meridian, together with Tasmania and (later) New Zealand. The developments of the first 71 years included the gradual lopping off of pieces of this territory, and the recognition of them as separate colonies, until only the portion now known as New South Wales remained. But almost as soon as the separating process commenced it was found wise to modify it by various attempts at re-linking the separated parts. In 1842 the legislative council of New South Wales passed an act to admit free of duty manufactured articles or produce from

Tasmania and New Zealand; the act, however, was disallowed by Lord Stanley, then colonial secretary, on the ground that 'a policy of discrimination would involve the commercial treaties and the foreign relations of Great Britain, and could not be satisfactorily dealt with except by the home government.' The fiscal policies of the colonies, differing as they did, soon created friction, and led Sir Charles Fitzroy on 29 September 1846 to write as follows to the colonial office:

> It appears to me that, considering its distance from Home, and the time that must elapse before the decision of Her Majesty's Government upon measures passed by the Legislatures of these colonies can be obtained, it would be very advantageous to their interests if some superior functionary were to be appointed, to whom all measures adopted by the local Legislatures, affecting the general interests of the mother country, the Australian colonies, or their intercolonial trade, should be submitted by the officers administering the several Governments, before their own assent is given to them.

This is the first recorded proposal for a central authority to deal with matters of common concern. On 31 July 1847 Earl Grey, then colonial secretary, outlined the first project for a national assembly. After enumerating the reasons for the creation of some central legislative assembly, he added:—

> Some method will also be devised for enabling the various legislatures of the several Australian colonies to co-operate with each other in the enactment of such laws as may be necessary for regulating the interests common to those possessions collectively. Such, for example, are the imposition of duties of import and export, the conveyance of letters, and the formation of roads, railways, or other internal communications traversing any two or more of such colonies—The subject of your own despatch of the 29th Sept., 1846, viz., the imposition of discriminating duties in any Australian colony, on goods, the growth, produce or manufacture of any other Australian colony, will also be adverted to, and provided for, in that part of the contemplated Act of Parliament which will relate to the creation of a central legislative authority for the whole of the Australian colonies.

In New South Wales the proposal was not received with any enthusiasm; it was mildly approved as unobjectionable, and possibly even useful, but of little immediate importance. The report of a committee of the privy council appointed in 1849 'to enquire into the constitutional changes which it might be advisable to make in the Government of the Australian colonies' carried the proposals a step further; the committee was of opinion that a uniform tariff should be established, with intercolonial freetrade, and proposed that

> One of the Governors of the Australian colonies should always hold from Your Majesty a commission constituting him the Governor-General of Australia. We think that he should be authorized to convene a body to be called the General Assembly of Australia, at any time and at any place within Your Majesty's Australian dominions which he might see fit to appoint for the purpose. But we are of opinion that the first convocation of that body should be postponed until the Governor-General should have received from two or more of the Australian legislatures addresses requesting him to exercise that power.
>
> We commend that the General Assembly should consist of the Governor-General, and of a single House, to be called the House of Delegates. The House of Delegates should be composed of not less than 20 nor more than 30 members. They should be elected by the legislatures of the different Australian colonies.

The bill which was introduced in 1849 for the separation of Victoria also provided for the creation of a general assembly on the lines of the report, and in a schedule set forth a uniform tariff; but these provisions were ultimately abandoned as premature, and the act for the separation of Victoria contained no reference to a federal authority. Earl Grey, however, did not wholly abandon the federal idea, and in 1851 sent out to the governor of New South Wales, besides four commissions appointing him governor of New South Wales, Tasmania, South Australia, and Victoria, a fifth appointing him 'Governor General of all Her Majesty's Australian possessions, including the colony of Western Australia.' Fitzroy was instructed not to interfere in internal administration, but to foster 'the completion of measures calculated to promote the common welfare' and the lieutenant-governors of Tasmania, Victoria, and South Australia were instructed to communicate with him on all measures affecting intercolonial interests. Only once did the governor-general actually concern himself with intercolonial interests. In 1855 Sir W. Denison (then governor of New South Wales) endeavoured to secure harmony between the tariffs of New South Wales and Victoria; but shortly afterwards responsible government was inaugurated in both colonies, and the governor-generalship fell into disuse. Its last shred of utility was, of course, gone when the several governors ceased to exercise control over the administration.

In 1853 a select committee of the legislative council of New South Wales, bringing up a report on a proposed new constitution, expressed the opinion that 'one of the more prominent legislative measures required by this colony, and the colonies of the Australian group generally, is the establishment at once of a General Assembly to make laws in relation to the intercolonial questions which have arisen and may hereafter arise among them.' A similar committee appointed the same year in Victoria also dealt with the question, but its proposals did not include a definite scheme. In the New South Wales proposition a list of subjects upon which the general assembly could legislate was given, but in the Victorian committee's report it was suggested that the body should deal with 'such questions as may be submitted to it by the Act of any Legislature of one of the Australian colonies.'

The constitution acts of 1855 (18 and 19 Vic. cc. 54-5) omitted any provision for a general assembly, and Lord John Russell, then colonial secretary, in a despatch stated that the matter had been considered and the government had concluded that the time was not opportune. In 1854 the project was kept alive by a series of letters in the *Sydney Morning Herald*, written by John West under the nom-de-plume of 'John Adams,' and in 1856 Edward Deas Thomson mentioned in the council the probability of some federal arrangement; but the next important stage was 'Wentworth's Memorial.' W. C. Wentworth, who had gone on a visit to England in 1854, in 1857 submitted to the colonial office a memorial and the draft of a short enabling bill, which had been adopted at a meeting of the General Association for the Australian Colonies, held in London on 31 March. The memorial referred to the necessity of a federal authority, and recommended the Imperial government to give, by means of a permissive act, 'to the legislatures of any two or more colonies a per-

missive power to form a federation themselves.' Complete equality of representation, as between all the Australian colonies, should be insisted upon without reference to the relative populations, and the federal assembly might in the first instance be 'perambulatory.' The bill empowered any two or more colonial legislatures to form a convention 'for the purpose of creating a Federal Assembly,' but laid down only a few rules as to its constitution. At the colonial office the scheme did not meet with a favourable reception; its acceptability in Australia was doubted, but copies of the correspondence were sent to the several governors.

In January 1857 Charles Gavan Duffy obtained the appointment of a select committee of the Victorian assembly 'to enquire into and report upon the necessity of a federal union of the Australian colonies for legislative purposes and the best means of accomplishing such a union if necessary.' The committee was unanimous as to the ultimate necessity of a federal union, and thought it was too soon to invite a mutual understanding on the subject; it recommended a conference (three delegates from each legislature) 'to frame a plan of federation to be afterwards submitted for approval, either to the Legislature or directly to the people, or both, and to receive final legislative sanction.' The recommendations were adopted by both Victorian houses, and forwarded to the other colonies. In New South Wales in August of the same year (1857) Deas Thomson obtained a select committee of the legislative council on the same subject. This committee endorsed the Victorian proposition, and put forward the outlines of a scheme. Had it been well backed up, union might have been achieved. Unfortunately, however, other influences were at work. During the deliberations of the committee, the Parker ministry (of which Deas Thomson was a member) had been replaced by a Cowper ministry with James Martin, its attorney-general, as its dominating personality. Neither Cowper nor Martin cared anything for federal union, and colonial politicians in general were engrossed in such questions as the franchise, the reform of the upper house, and the land question. Moreover, the rivalry between New South Wales and Victoria was already leading to jealousy and bad feeling, since the stream of immigration to the goldfields had suddenly given Victoria the lead in population; and Duffy's overtures were received with suspicion as part of a scheme of Victorian aggrandizement. Deas Thomson succeeded in securing the adoption of his report by the council; the assembly was asked to concur, and joint resolutions, based on the Victorian recommendations, were agreed to in conference; their consideration by the assembly was fixed for 18 December, and on the 17th the Cowper ministry was defeated on a crown lands bill, and a dissolution followed. On the reassembling of parliament in March 1858 the federal question was shelved; the assembly resolved that the discussion 'may, under existing circumstances, be deferred,' whilst the council resolved more emphatically that it 'must, under existing circumstances, be deferred.' Deas Thomson seems to have then resigned himself to the inevitable.

In South Australia a select committee in 1857 was of opinion that the promotion of a federal legislature would be premature; it adopted the Victorian proposal for a conference, but delegates were only to 'discuss and report.'

From 1857 to 1860 the history of the movement is a record of select committees and resolutions only. Duffy obtained committees of the Victorian assembly in December 1857 and January 1860; Tasmania resolved to appoint delegates to any conference; but the stumbling block was New South Wales. William Forster, who became premier in 1859, was no more enthusiastic than his predecessors. Even if New South Wales had fallen into line and a conference been held, it is doubtful if any practical result would have followed. To quote Quick and Garran:—'In no colony was there any general enthusiasm, or even interest, in the subject; though in all there were a few far-sighted statesmen who recognized the essential unity of Australia. Even in Victoria, whose statesmen showed the most eagerness for union, there was nothing approaching a real federal movement. Local politics, and the development of local institutions, engrossed the attention of the people; and probably no colony would have been prepared to accept the compromises and the partial sacrifices of local independence which a federal union would have involved. The best justification of the inaction of the Imperial Government is the want of interest shown by the colonies themselves.'

From 1863 to 1880 questions requiring concerted action were dealt with by intercolonial conferences. At one held at Melbourne in March 1867, Henry Parkes made a memorable speech:—'I think the time has arrived when these colonies should be united by some federal bond of connection . . . . there are questions projecting themselves upon our attention, which cannot be satisfactorily dealt with by any one of the individual Governments. I regard this occasion, therefore, with great interest, because I believe it will inevitably lead to a more permanent federal understanding.' In 1870 Duffy in Victoria made another effort to advance federation by securing the appointment of a royal commission to consider the subject; but, beyond a preliminary report nothing was done. At an intercolonial conference which met at Melbourne in November and December 1880 to discuss the subject of a uniform tariff, resolutions passed at the instance of Henry Parkes affirmed the desirability of creating a federal council, and New South Wales was requested to prepare the necessary bill. A bill was accordingly submitted to the conference at a later meeting in January 1881; the accompanying memorandum stated that in respect to the federal council bill now submitted, the following positions are assumed as hardly open to debate:—(1) that the time is not come for the construction of a federal constitution, with an Australian federal parliament; (2) that the time is come when a number of matters of much concern to all the colonies might be dealt with more effectually by some federal authority than by the colonies separately; (3) that an organization which would lead men to think in the direction of federation and accustom the public mind to federal ideas, would be the best preparation for the foundation of federal government. In a division on the acceptance of the bill New South Wales, South Australia, and Tasmania voted for the bill, and Victoria, Queensland, and New Zealand against, the Western Australian delegates abstaining from voting. The proposal was therefore abandoned.

The Federal Council.—Up to this point every effort to effect a federation of any kind had

been abortive. But in June 1883 the junction of the railway system of New South Wales with that of Victoria was effected, and during the accompanying festivities reference was made to federation. James Service, the Victorian premier, said 'We want federation, and we want it now,' but other speakers were not so enthusiastic. The most powerful incentive to federation, however, came from outside. In 1883 rumours were in the air that Germany had designs on New Guinea, and that France was coveting the New Hebrides and intended to transport to New Caledonia a number of recidivistes or habitual criminals. The executive council of Queensland on 17 July resolved that the imperial parliament should be invited to move in the direction of federal union. Service took more practical action by inviting an intercolonial conference, which met in Sydney on 28 November, seven colonies and Fiji being represented. Service was for federation 'pure and simple,' but the other delegates were not prepared to follow him. On the motion of Samuel Griffith, premier of Queensland, it was decided that a federal Australasian council should be created, and a bill (drafted by Griffith) was adopted by the convention. Each self-governing colony was to have two representatives on the council—crown colonies were to have one. The council was to be a legislature merely, with no executive powers and no control over revenue or expenditure. Even its legislative powers were very scanty, the matters over which it was given independent legislative authority being only seven. Foremost of these were 'the relations of Australasia with the islands of the Pacific' and 'prevention of the influx of criminals'—the two burning questions which had led up to the convention. The others related to fisheries in Australasian waters outside territorial limits, the service of civil process beyond the limits of a colony, the enforcement of judgments and of criminal process beyond the limits of a colony, the extradition of offenders, and the custody of offenders on government ships beyond territorial limits. Those were the only matters on which the council could legislate on its own motion. There was a second list of matters which the legislatures of two or more colonies might refer to the council, and on which the council might then legislate, but only so as to affect the referring or adopting colonies. This list comprised defence, quarantine, patents and copyright, bills of exchange and promissory notes, weights and measures, recognition of marriage and divorce, naturalization, status of corporations, and 'any other matter of general Australasian interest with respect to which the legislatures of the several colonies can legislate within their own limits, and as to which it is deemed desirable that there should be a law of general application.' All laws of the council were to be presented, for the royal assent, to the governor of the colony in which the council was sitting.

In July and August 1884 addresses praying for the enactment of the bill were passed by the legislatures of Victoria, Tasmania, Queensland, Western Australia, and Fiji, but New South Wales and New Zealand stood aloof. In New South Wales resolutions approving of the bill were brought before both houses of parliament; in the council the resolutions were carried by 13 to 9, in the assembly they were defeated by one vote. John Robertson and others frankly opposed union on the ground of mistrust of the other colonies; but the most general objection was that the scheme was premature, ill-conceived and ineffective. Henry Parkes referred to the proposed council as a 'rickety body,' and contended that it would impede the way for a sure and solid federation. The British government, acting on the addresses presented to it, decided to proceed with the matter, and passed 'The Federal Council of Australasia Act 1885' which became law on 14 August of that year. The act differed in some respects from the bill adopted by the convention. In the first place, a provision was inserted giving any colony the power to secede from the council; this was done in the hope that New South Wales might thereby be induced to join, one of the objections of that colony being the irrevocableness of the compact. Next, power was given to the Queen, at the request of the colonies, to increase the number of members of the council; it was hoped that this might lead to the gradual extension and development of federal institutions. Lastly, the council was given power to legislate on any matter which, at the request of the colonial legislatures, the Queen should think fit to refer to it.

Between September and December 1885 adopting acts were passed by Western Australia, Fiji, Queensland, Tasmania, and Victoria, and all these colonies sent representatives to the first meeting of the council, held at Hobart from 25 January to 5 February 1886. The council met again in 1888 and 1889. In December 1888 South Australia agreed to join for two years, but at the end of this period the colony withdrew. From 1891 to 1899 the council met in alternate years, but did little to justify its existence—a fact which its friends ascribed to the aloofness of New South Wales. The council met for the last time in Melbourne in 1899.

The Commonwealth Bill of 1891.—The immediate stimulus that brought about the convention of 1891 arose from the necessity of combined action regarding colonial defence. At the colonial conference of 1887 it was suggested that an imperial officer should be appointed to report on this subject, and in 1889 Major-general Sir J. Bevan Edwards was commissioned to inspect and report. On receipt of the general's report Parkes suggested a consultation of premiers, but Gillies, premier of Victoria, proposed that New South Wales should join the federal council and have the matter discussed by that body. This suggestion did not meet with Parkes's approval; he had come to the conclusion that popular sentiment was now ripe for a definite federal movement, at the head of which he resolved to place himself. At the time he was on a short visit to Brisbane, where he had received encouragement from the leading men of both political parties; and on his return journey he was no sooner within New South Wales territory than he opened out with his famous Tenterfield speech of 24 October 1889. In this he emphasized the necessity of federal defence, for which purpose the federal council would be altogether inadequate, because it had no executive power, and was not directly responsible to anyone; nor would it be enough to ask the imperial parliament to pass an act authorizing the troops of the colonies to unite in one federal army under imperial control. What was wanted was a strong central executive, under the control of the Australian people.

After some hesitation on the part of the

other premiers, Parkes obtained their consent to an 'informal' meeting. Accordingly on 6 February 1890 a conference met at Melbourne. New South Wales sent Henry Parkes (premier) and William McMillan (treasurer); Victoria, Duncan Gillies (premier) and Alfred Deakin (chief secretary); Queensland, Samuel Griffith (leader of the opposition) and John Macrossan (colonial secretary); South Australia, John Cockburn (premier) and Thomas Playford (leader of the opposition); Tasmania, Inglis Clark (attorney-general) and Stafford Bird (treasurer); Western Australia, James Lee Steere (speaker); New Zealand, Captain William Russell Russell (colonial secretary) and John Hall. At the inevitable banquet two famous phrases were born. James Service spoke of the tariff question as 'the lion in the path' which federalists must either slay or be slain by; and Henry Parkes responded that 'the crimson thread of kinship runs through us all.' The convention passed various resolutions, the principal of which pledged the delegates to induce the legislatures of their colonies to appoint delegates to a national Australasian convention. All the colonies agreed, and appointed delegates, but New Zealand's were instructed not to bind the colony in any way. On 2 March 1891 the convention met at Sydney. Sir Henry Parkes, W. McMillan, J. P. Abbott, G. R. Dibbs, W. H. Suttor, Edmund Barton, and Sir Patrick Jennings represented New South Wales. From Victoria came Alfred Deakin, James Munro, W. Collard Smith, Nicholas Fitzgerald, H. J. Wrixson, Duncan Gillies, H. Cuthbert, and William Shiels; from Queensland J. M. Macrossan, John Donaldson, Sir S. W. Griffith, Sir Thomas McIlwraith, Arthur Rutledge, A. J. Thynne, and Thomas Macdonald-Paterson; from South Australia Richard Chaffey Baker, John H. Gordon, Sir John C. Bray, Dr. John A. Cockburn, Sir John W. Downer, Charles C. Kingston, and Thomas Playford; from Tasmania William Moore, Adye Douglas, A. Inglis Clark, W. H. Burgess, Nicholas J. Brown, Bolton S. Bird, and Philip O. Fysh; from Western Australia John Forrest, W. E. Marmion, Sir James G. Lee Steere, John A. Wright, John Winthrop Hackett, Alexander Forrest, and W. T. Loton; from New Zealand Sir George Grey, Captain W. R. Russell, and Sir Harry A. Atkinson. The first act of the convention was to appoint Sir Henry Parkes to the position of president; Sir Samuel Griffith was appointed vice-president. Parkes then submitted a series of resolutions with the object of 'obtaining a preliminary interchange of ideas and laying down a few guiding principles.' They read as follows:—

That in order to establish and secure an enduring foundation for the structure of a federal government, the principles embodied in the resolutions following be agreed to:—

1. That the powers and privileges and territorial rights of the several existing colonies shall remain intact, except in respect to such surrenders as may be agreed upon as necessary and incidental to the power and authority of the National Federal Government.

2. That the trade and intercourse between the federated colonies, whether by means of land carriage or coastal navigation, shall be absolutely free.

3. That the power and authority to impose customs duties shall be exclusively lodged in the Federal Government and Parliament, subject to such disposal of the revenues thence derived as shall be agreed upon.

4. That the military and naval defence of Australia shall be entrusted to federal forces, under one command.

Subject to these and other necessary provisions, this Convention approves of the framing of a federal constitution, which shall establish:—

1. A parliament, to consist of a senate and a house of representatives, the former consisting of an equal number of members from each province, to be elected by a system which shall provide for the retirement of one-third of the members every years, so securing to the body itself a perpetual existence combined with definite responsibility to the electors, the latter to be elected by districts formed on a population basis, and to possess the sole power of originating and amending all bills appropriating revenue or imposing taxation.

2. A judiciary, consisting of a federal supreme court, which shall constitute a high court of appeal for Australia, under the direct authority of the Sovereign, whose decisions, as such, shall be final.

3. An executive, consisting of a governor-general and such persons as may from time to time be appointed as his advisers, such persons sitting in Parliament, and whose term of office shall depend upon their possessing the confidence of the house of representatives, expressed by the support of the majority.

The discussion of these resolutions occupied 11 sitting days. The main debate, extending over two days, was on the power of the senate with regard to money bills—a subject which at one time threatened to wreck the convention. On 18 March three committees were appointed to deal with the constitutional machinery, the financial and fiscal problems, and the judiciary; and in the course of the next 12 days was framed the first draft of a bill to constitute the Commonwealth of Australia. This marks an epoch in the history of the movement. In those few days federation was once for all crystallized into a practical scheme, complete in all its details, though as to many of the details, and even many of the principles, there was still to be keen and protracted dispute.

The deliberations of the committees were private. The last stage in the process of drafting the constitution was completed by a sub-committee consisting of Sir Samuel Griffith, C. C. Kingston, Edmund Barton and Inglis Clark, and on 31 March Sir Samuel Griffith, who had the chief hand in the actual drafting of the bill, brought up a draft bill to constitute the Commonwealth of Australia, to which the reports of the finance and the judiciary committees were appended. This practically completed the convention's work, for, except that the mode of distributing the surplus was readjusted, the bill as it came from the draftsmen was, with a few verbal alterations, adopted in its entirety. A few points of interest claim mention. The word 'Commonwealth' is used for the first time; it was first adopted provisionally for want of a better, but was so apt a description that it came to stay. The fiscal policy and the great inequalities of population were stumbling-blocks; the former was left to the federal parliament to decide, and the latter was minimized by a judicious compromise.

On 9 April the convention dissolved, and it became necessary to submit the bill to the colonial legislatures. In New South Wales there was much delay. When parliament opened in May, Parkes gave notice of resolutions in favour of the bill, but before they could be moved the house was dissolved. In the new parliament, which met in July, a new element—the Labour party, 30 strong in a house of 141—was present. This party supported the government, but was not zealous in the cause of federation, which therefore remained an unconsidered item on the

government's programme until in October Parkes was driven out of office. In Victoria the bill was discussed by both houses and amended in some particulars; there was strong opposition to the admission of New Zealand and ultimately an amendment was carried to exclude it unless it came in as an original State. In South Australia the bill was considered in a leisurely fashion, it being recognized that until New South Wales made a definite decision the movement was lifeless. Ultimately the bill was reported with amendments in December 1892. In Tasmania some effort was made to deal with the question, but on rather different lines. There it was proposed to ask the houses to consider the bill first, and then to remit it to the consideration of a provincial convention elected by the voters of Tasmania. Accordingly in July 1891 a 'Commonwealth of Australia Bill' was introduced by the attorney-general providing for the election of 50 representatives to consider the bill. The draft constitution was also considered by the house in committee. After several adjournments and other delays the business was ultimately shelved, on the ground that Tasmania's part in the matter was to follow, not to lead. Western Australia and New Zealand took little interest in the matter; indeed, in New Zealand an abstract motion by Sir George Grey on the subject of federation, but having no direct reference to the convention bill, was unceremoniously counted out. In Queensland Sir Samuel Griffith announced his readiness, and that of his colony, to follow the lead of New South Wales. All Australia, in fact, was waiting for New South Wales.

When Parkes, the recognized leader of the movement, retired from office in October 1891, the prospects of immediate action in the New South Wales parliament grew faint. George Reid and a large section of freetraders put free-trade before federation; the Labour party put social questions before federation. G. R. Dibbs, the new premier, was no friend of the bill, nor were most of his colleagues; but Barton, who was already recognized as Parkes's federal lieutenant (though in colonial politics they were on opposite sides), accepted the attorney-generalship in the Dibbs ministry on the understanding that he was to have a free hand in dealing with federation, and R. E. O'Connor, also an earnest federalist, took the portfolio of minister of justice.

On 23 November 1892 Barton introduced resolutions approving the main principles of the bill and expressing the opinion that amendments made by the colonial legislatures should be dealt with in a second convention. The same resolutions were moved in the legislative council by R. E. O'Connor on 17 May 1893. Both houses carried the resolutions—and there the matter ended. With the resignation of Barton and O'Connor from the ministry in December (for reasons unconnected with federation) all hope of finalizing federation on the lines of the bill was shattered.

Intervention of the Public.—Up to 1892 the public had not been concerned greatly with the subject of federation, though in Victoria the Australian Natives' Association had done something to stir up popular sentiment. But in March 1893 the annual conference of the association recognized the necessity of kindling popular sentiment, and a deputation from it urged Barton to form a central federation league in Sydney; leagues had already been formed at Corowa and Albury, but the necessity of a central league was apparent. At a public meeting held in the Sydney town hall on 3 July 1893 a central league was created, and at the end of 1893 and beginning of 1894 other leagues were formed in Melbourne, Bendigo, Ballarat, Echuca, and other Victorian towns. In August 1895 a league was formed at Adelaide, in July 1898 at Brisbane, and in July 1899 one at Auckland in New Zealand. On 31 July and 1 August 1893 a conference of leagues was held at Corowa in New South Wales, and was made historically important by a resolution moved by Dr. John Quick—'That, in the opinion of this Conference, the Legislature of each Australasian colony should pass an Act providing for the election of representatives to attend a Statutory Convention or Congress to consider and adopt a Bill to establish a Federal Constitution for Australia, and upon the adoption of such Bill or measure it be submitted by some process of referendum to the verdict of each colony.' This scheme—the essence of which was to substitute a popular for a parliamentary election of delegates to the next convention—was adopted with a slight modification by the central league at Sydney.

Dibbs at Tamworth on 22 May 1894 propounded a scheme of complete unification to take the place of federation, but it was condemned by federalists as impracticable. But George Reid, who succeeded Dibbs as premier on 3 August, immediately placed federation on his programme. At a conference of premiers (George Reid of New South Wales, George Turner of Victoria, H. M. Nelson of Queensland, C. C. Kingston of South Australia, Sir Edward Braddon of Tasmania, and Sir John Forrest of Western Australia) held at Hobart on 29 January 1895, Reid moved resolutions of which the principal were (*a*) that a convention, consisting of ten representatives from each colony, directly chosen by the electors, be charged with the duty of framing a federal constitution, and (*b*) that the constitution so framed be submitted to the electors for acceptance or rejection by a direct vote. These being accepted, Reid in October 1895 introduced into the legislative assembly of New South Wales an enabling bill which received the royal assent on 23 December; it included a provision requiring 50,000 affirmative votes before the constitution could be accepted by the colony. New South Wales having led the way, other colonies were not slow to follow. South Australia, under Kingston's leadership, took action as soon as it was clear that New South Wales was in earnest, and dealt with its enabling bill so promptly that it became law on 20 December—three days in advance of the mother-colony. In the South Australian bill no minimum vote was stipulated for. The Tasmanian bill, introduced by Sir Edward Braddon, was passed on 10 January 1896; it required a minimum affirmative vote of 6000—representing about the same proportion of voters as the New South Wales minimum. In Victoria, an enabling act had been introduced by George Turner in December and had passed the assembly almost without opposition, the division on the second reading being 71 to 4; in the council an amendment was made which the assembly regarded as infringing its money powers, and which resulted in a temporary deadlock. In February, however, a second bill was introduced, and became law on 7 March. It required a minimum vote of 50,000. In Queensland, through a difference

between the two houses, the bill was laid aside. In Western Australia an enabling bill was passed, but the constitution was only to be submitted to the people 'if approved by parliament,' and delegates were to be selected by the parliament.

The elections in four colonies were held on 4 March 1897. New South Wales chose as delegates Edmund Barton, G. H. Reid, J. H. Carruthers, W. McMillan, W. J. Lyne, J. N. Brunker, R. E. O'Connor, Sir J. P. Abbott, J. T. Walker, and B. R. Wise. Victoria chose Sir George Turner, John Quick, Alfred Deakin, A. J. Peacock, I. A. Isaacs, W. A. Trenwith, Sir Graham Berry, Simon Fraser, Sir William A. Zeal, and H. B. Higgins. From South Australia came C. C. Kingston, F. W. Holder, J. A. Cockburn, Sir R. C. Baker, J. H. Gordon, J. H. Symon, Sir John Downer, P. McM. Glynn, J. H. Howe, and V. L. Solomon; and from Tasmania Sir Philip O. Fysh, Sir Edward Braddon, Henry Dobson, N. E. Lewis, Nicholas J. Brown, C. H. Grant, Adye Douglas, William Moore, M. J. Clarke, and John Henry.

The first meeting of the convention was fixed for 22 March, and on the 12th the Western Australian parliament amended its enabling act, so as to allow a more speedy selection of the representatives of that colony. They were Sir John Forrest, Sir James G. Lee Steere, George Leake, F. H. Piesse, J. W. Hackett, W. T. Loton, W. H. James, A. Y. Hassell, R. F. Sholl, and J. H. Taylor; but in August Piesse, Loton, Sholl, and Taylor resigned, and were replaced by Henry Briggs, F. T. Crowder, A. H. Henning, and H. W. Venn. This was a notable gathering. It included the premiers of five colonies, the speakers of three, nine other ministers, and 11 ex-ministers.

The convention met at Adelaide on 22 March 1897. Kingston, as premier of the colony, was elected president, and Barton 'leader;' and it was decided not to take the bill of 1891 as the avowed basis of a new constitution, but to start from the beginning. Barton submitted resolutions on the lines laid down by Parkes in 1891, and three committees were then chosen: the constitutional committee was dominated by Barton, Deakin, and Sir R. Baker, but the actual drafting of the constitution was entrusted to Barton, Downer, and O'Connor. On the judiciary committee Higgins, Glynn, and Symon were the leaders. This committee finished its work on 6 April; in the other two the debates were somewhat prolonged, and they did not finish till the 8th. Then the drafting sub-committee prepared a bill, which was submitted to the convention on the 12th. Its framework followed closely that of the bill of 1891. Alterations were made in the basis of representation, in the judiciary, in finance, and in the mode of amending the constitution. During the discussions in committee the most momentous debate was on a clause empowering the senate to amend laws imposing taxation—an extremely important issue, since in the senate all States were to have equal representation, while in the house of representatives (which alone could originate money bills) the more populous States could out-vote the emptier. Thus, if the senate was given power to amend money bills, the less populous States could to some extent control expenditure. Barton, however, pointed out that New South Wales and Victoria would not accept such terms, and it was agreed to retain a compromise arranged in 1891, by which the senate might 'suggest' amendments to money bills, but could not make them. On 22 April the bill was reported to the convention, and adopted the next day; the convention then adjourned until 5 May and was then further adjourned until 2 September, to allow the colonial legislatures time to discuss the bill.

In New South Wales discussion commenced on 5 May, and a number of amendments were suggested; in the legislative council the bill received very hostile treatment. In Victoria and the other colonies the bill was more favourably received but the smaller colonies decided in favour of giving the senate power to amend money bills.

On 2 September the convention assembled in Sydney to consider the proposed amendments, which were 286 in number. As another sitting was inevitable, it was decided to discuss at this one only the larger issues and the debates dealt with the financial problem, the basis of representation in the senate, the powers of the senate with regard to money bills, and the provision for deadlocks between the two houses. On 24 September the convention adjourned, to meet for its final session at Melbourne. The interval between the sessions was seized upon in New South Wales by the opponents of the convention to stem the tide, fast flowing towards a federal union, the force of which they had not recognized before. In June, a bill had been introduced into the assembly by a private member 'to amend the Enabling Act by requiring an affirmative vote at the federal referendum of an absolute majority of all the electors on the roll.' As about 278,000 electors were on the roll, this meant an affirmative vote of some 139,000; there were not sufficient members to go to this extreme, but enough were found to increase to 80,000 the minimum affirmative vote of 50,000 imposed by the enabling act, and on 12 December the bill became law.

On 20 January 1898 the convention assembled at Melbourne for its longest and most important session. The whole bill was thoroughly revised by the drafting committee and thoroughly reconsidered by the convention. During the debate on the financial clauses the famous 'Braddon Clause' (q.v.) was inserted in the bill. On the question of the site of the federal capital, a proposition by Sir George Turner that it should be 'within federal territory' was carried. On 13 March 1898 the convention held its last sitting.

The Referendum of 1898.—The next stage in the history of the bill was to submit it to the electors of the various colonies. In New South Wales formidable opposition was met. J. H. Want resigned his position in the ministry to fight the bill untrammelled. The Sydney *Daily Telegraph* declared against it, and a strong anti-convention bill league was formed. Reid did not declare his policy until 28 March, when he stated that he personally would vote for the bill, but would abstain from any recommendation to the electors, one way or the other. The federalists for their part conducted an active campaign and formed the New South Wales Federal Association. The *Sydney Morning Herald* and the *Evening News* supported the bill. At a late stage the government appointed a commission, consisting of J. Russell French (a banker whose federal views were unknown), Normand MacLaurin (a strong critic of the bill) and Bruce Smith; witnesses were examined, and on 17 May a report was presented which —like Reid's speeches—was claimed by each side

as in its favour. In Victoria the fight was one-sided from the outset, chiefly because of the influence of the Australian Natives' Association. The financial obstacles, too, were less grave than in New South Wales. The anti-bill party was led by H. B. Higgins and Allan McLean. In South Australia the federal representatives united in an appeal to the electors to vote for the bill, and the issue was never in doubt. In Tasmania dissatisfaction was expressed for a time at the provisions limiting the powers of the senate, and fears were expressed that sufficient revenue would not be available for the State under the Braddon clause, but the federalists combated these objections successfully. Western Australia did not take a vote, preferring to await the issue in the other States. The referendum was taken on 3 June 1898 in New South Wales, Victoria, and Tasmania, and on the 4th in South Australia. The result was as follows:—

	N.S.W	Vic.	S.A.	Tas.	Total
For ..	71,595	100,520	35,800	11,797	219,712
Against	66,228	22,099	17,320	2,716	108,363
Majority	5,367	78,421	18,480	9,081	111,349

There was thus a majority for the bill in each of the four colonies. In Victoria, South Australia, and Tasmania the majorities were decisive; but in New South Wales not only was the majority a slender one, but the total affirmative vote fell short by 8405 of the 80,000 minimum required by the act of 1897. In New South Wales therefore, under the provisions of the act, the barely victorious bill was 'deemed to be rejected,' and the whole statuary process, so far as New South Wales was concerned, was at an end. It was recognized by the federal leaders that the next move must be made by Reid. He lost no time; the day after the referendum he suggested to the premiers of the other colonies a conference on proposed amendments, but, as New South Wales was on the eve of a general election, the consensus of opinion favoured delay until the election had been held. On 21 June, before parliament was dissolved, Reid made proposals for modification of the bill, to which Barton and O'Connor objected on the ground that they were practically an ultimatum. At the ensuing election federation became a party question, Reid leading the 'Liberal Federal' party and Barton the 'National Federal' party. Reid defeated Barton, but his parliamentary majority, which had been large, was reduced to about four. Parliament met on 16 August, and Reid introduced resolutions studiously moderate in tone, which the assembly passed with slight additions, the council making more drastic amendments. No attempt was made to harmonize the two sets of resolutions.

On 29 January 1899 the premiers met in Melbourne to consider the suggestions of New South Wales. For the first time since 1895 Queensland was represented at the conference, which lasted until 2 February and resulted in a unanimous agreement. Seven amendments were made in the bill, six at the instance of New South Wales and one at the instance of Queensland. Among them, a provision as to the site of the capital city fixed it definitely in New South Wales, but at least 100 miles from Sydney. The Braddon clause—the temporary retention of which was a general surprise, for it had few friends—was affected by an amendment which placed it, after ten years, at the mercy of the federal parliament. Reid announced that he would support the amended bill with all his power, and on the reassembling of the New South Wales parliament on 21 February introduced a new enabling bill; this provided for a referendum on the amended constitution, at which a simple majority was to decide. The bill passed the assembly with slight opposition, but met with strong hostility from the council; on 30 March parliament was prorogued, and 12 new members were appointed to the council. The hint was accepted, and when parliament met again the enabling bill passed.

The referendum was taken on 20 June. In South Australia a new enabling act was passed in March, and the vote taken on 29 April. Victoria and Tasmania, when the verdict of New South Wales was known, passed enabling acts and fixed 27 July as referendum day. In Queensland an enabling bill was introduced by the premier, which met with strong opposition, but became law on 19 June; the referendum was taken on 2 September. The total results of the voting were as follows:—

	N.S.W.	Vic.	S.A.	Tas.	Qld.	Total
Yes.	107,420	152,653	65,990	13,437	38,488	377,988
No..	82,741	9,805	17,053	791	30,996	141,386
Majority .	24,679	142,848	48,937	12,646	7,492	236,602

The bill was therefore carried in all five colonies.

It will be noted that Western Australia took no referendum. Sir John Forrest's support of the bill slackened, and it was not till July 1899 that the constitution was submitted to the parliament of Western Australia, but amendments proposed in the assembly and the hopeless tangle that occurred in the council prevented the submission of the bill to the people.

The Final Stage.—The next step was to pass through the various legislatures addresses praying that the constitution should be passed into law by the imperial parliament. This done, on 22 December 1899 Joseph Chamberlain (then secretary of state for the colonies) telegraphed his hope that a delegation from the federating colonies would visit England and be present when the Commonwealth bill was submitted to the imperial parliament. It was therefore arranged that a delegation should be sent, consisting of Edmund Barton, Alfred Deakin, J. R. Dickson (of Queensland), and C. C. Kingston, and that they should be joined in London by Sir Philip Fysh. It was agreed that the delegation should unitedly urge the passage of the bill without amendment, and act as one man in explaining legal or constitutional questions. The government of Western Australia expressed a desire to be represented, and (with the concurrence of the secretary of state) despatched S. H. Parker, as its delegate.

Towards the middle of March 1900 the delegates arrived in London. Barton was appointed spokesmen, and on 15 March they had their first informal conference with Chamberlain and the crown law officers. The chief objection was made to clause 74, which restricted the right of appeal to the privy council. On 27 March W. P. Reeves, agent-general for New Zealand, informed the colonial office that he had been appointed a delegate, and a few days later forwarded a memorandum of amendments desired by his colony. On the 30th the Western Australian delegate also forwarded a memorandum asking that Western Australia should be allowed for five years after the imposition of the federal tariff, to receive the customs duties in force

at the passing of the Commonwealth act. If this amendment were made, he said, Western Australia would probably enter the Commonwealth.

Then followed conferences, memoranda, and minutes, through all of which the delegates from eastern Australia steadily urged that the bill should be passed as adopted by the five colonies. Chamberlain, on the other hand, was—or the law officers who advised him were—anxious to alter the clause restricting the right of appeal to the privy council; he referred the matter over the delegates' heads to their premiers, who conferred in Melbourne from 19 to 21 April and replied that the mandate of the Australian people was to seek the enactment of the bill in the form in which it was adopted by the people. On 27 April Chamberlain cabled to Western Australia urging the colony to join the Commonwealth as an original State, and was told in answer that parliament had been summoned for 17 May, and an enabling bill would be immediately introduced. On 14 May Chamberlain introduced the Commonwealth Bill into the house of commons; the second reading was moved on 21 May, and Chamberlain announced that a settlement had been arrived at with the delegates in regard to the form of proposed amendments. On 16 June the privy council appeals clause (74) was remodelled in the form in which it now stands in the constitution. In the house of lords the bill was read a first time on 26 June; the second reading was moved on the 29th; on 3 July the bill passed through committee without amendment, and on the 5th was read a third time and passed. On the 9th the Queen gave her assent to the bill, signing the commission, declaring her assent to the bill in duplicate at the delegates' request, and gave one of the copies, as well as the pen, inkstand, and table she had used, to be preserved in the federal parliament buildings.

In the meantime, the parliament of Western Australia had taken action. On 13 June an enabling bill, on the lines of those passed by the other colonies, was assented to, and referendum day fixed for 31 July. The result of the vote was as follows:—Yes 44,800; No 19,691; Majority for bill 25,109. On 21 August both houses passed the necessary addresses to the Queen. The proclamation by Her Majesty of the Commonwealth had been delayed until Western Australia had arrived at a decision, and it was now decided to call the Commonwealth into being on 1 January 1901. On 17 September 1900, therefore, Her Majesty signed a proclamation in the following terms:—

> Whereas by an Act of Parliament passed in the Sixty-third and Sixty-fourth Years of our reign intituled "An Act to constitute the Commonwealth of Australia" it is enacted that it shall be lawful for the Queen, with the advice of the Privy Council, to declare by Proclamation, that, on and after a day therein appointed, not being later than One year after the passing of this Act, the people of New South Wales, Victoria, South Australia, Queensland and Tasmania, and also if Her Majesty is satisfied that the people of Western Australia have agreed thereto, of Western Australia, shall be united in a Federal Commonwealth under the name of the Commonwealth of Australia.
>
> And whereas We are satisfied that the people of Western Australia have agreed thereto accordingly.
>
> We therefore, by and with the advice of Our Privy Council, have thought fit to issue this Our Royal Proclamation and We do hereby declare that on and after the first day of January One thousand nine hundred and one, and people of New South Wales, Victoria, South Australia, Queensland, Tasmania and Western Australia shall be united in a Federal Commonwealth under the name of the Commonwealth of Australia.
>
> Given at Our Court at Balmoral this Seventeenth day of September, in the Year of our Lord One thousand nine hundred and in the sixty-fourth year of our reign.
>
> GOD SAVE THE QUEEN.

On 14 July 1900 it had been officially announced that the first governor-general of the Commonwealth would be the Earl of Hopetoun, and the official appointment was made on 21 September. An announcement was made at the same time that the Duke and Duchess of York would visit Australia early in 1901 and that the Duke would be commissioned by Her Majesty to open the first session of the federal parliament in her name.

The history of the movement towards federation is fully told in Quick & Garran's *Annotated Constitution of the Australian Commonwealth* (Sydney, 1901). The later campaigns are described well, but with some bias, in Wise's *Making of the Australian Commonwealth* (London, 1913); and the constitution is thoroughly examined and annotated both in the Quick and Garran volume and in Harrison Moore's *Constitution of the Commonwealth of Australia* (2nd edition Melbourne, 1910). A good deal of light is thrown on the early stages of the 1883-1897 campaign in Sir Henry Parkes's *Fifty Years in the Making of Australian History* (London, 1892).

Fellows, THOMAS HOWARD (1823-1878), son of a Hertfordshire solicitor, was born in 1823, educated at Eton, trained for the law under Tompson Chitty, and called to the bar in 1852. Almost immediately he migrated to Victoria, was admitted to the local bar, and in 1855 entered politics as a member of the old legislative council. In June 1856 he succeeded Robert Molesworth as solicitor-general in the first Haines ministry; later in the year he was returned by St. Kilda to the new assembly; and in the February following he took W. F. Stawell's place as attorney-general when the latter was made chief justice. In the second Haines ministry (1857-8) he was again solicitor-general; when Haines was defeated, he left the assembly for the council and in that body represented the Nicholson ministry from October 1859 to November 1860; he was postmaster-general in the first McCulloch ministry from October 1863 to March 1864, but then resigned because his policy differed entirely from that of his colleagues, and in the succeeding years opposed bitterly McCulloch's attempts to 'tack' tariff and other clauses to the annual appropriation bill. This three-years' fight—during which Fellows was more than once approached to form a ministry, and, vacating his seat in the council, was re-elected by St. Kilda to the assembly—ended in the formation of the two-months' Sladen ministry, in which Fellows was minister for justice. From July 1868, when that ministry came to an end, until February 1872 he held his assembly seat, devoting much time (as always) to his profession, in which he attained eminence; he was then made a judge of the supreme court, and remained on the bench until his death on 8 April 1878.

Felton, ALFRED (1831-1904), born at Maldon in Essex on 8 December 1831, was attracted to Victoria by the news of the great gold-rush and reached Melbourne in 1853 to open in the business of wholesale druggist and

general merchant. In 1866 he joined F. S. Grimwade in founding the drug-importing and manufacturing firm of Felton, Grimwade & Co., and in later years acquired much pastoral property. Never married, he employed his constantly increasing wealth mainly on charitable and artistic objects, and, when he died on 8 January 1904, left an estate of (roughly) £400,000 to be applied to these objects in equal shares. The terms and results of the Felton bequest for art purposes, through which the national gallery of Victoria in 1905-22 acquired nearly £200,000 worth of pictures and sculpture, are discussed under ART GALLERIES. A similar amount has been distributed among charities.

Ferguson, SIR JAMES (1832-1907), born in Edinburgh on 14 March 1832 and educated at Rugby and Oxford, entered the army as ensign in 1851, and served with his regiment (the Grenadier Guards) in the Crimean war until May 1855, when he returned to Scotland to represent Ayrshire in the British parliament. After a somewhat chequered parliamentary career he became under-secretary to the India office in 1866, and took the same post in the home office in 1867, winning the reputation of an excellent and helpful subordinate. In 1868, when Disraeli succeeded Lord Derby as premier, Fergusson accepted the governorship of South Australia, and reached Adelaide on 16 February 1869. His term of office there included little of importance that a constitutional governor could greatly influence, but he gave all possible aid to the establishment of the overland telegraph line to Port Darwin and of through communication with England by this means. Leaving South Australia in 1873, he was for a short time (14 June 1873 to 3 December 1874) governor of New Zealand, but in 1875 returned to England and unsuccessfully attempted to re-enter parliament. In 1880 he succeeded Sir R. Temple as governor of Bombay, where he had real power, and used it to improve the condition of the agricultural population and avert famines, besides developing the port of Bombay and encouraging education. Politics, however, were his hobby; in 1885 he hurried home to resume his parliamentary career, gaining the seat of North-east Manchester in November and holding it for 20 years, during which he was under-secretary to the foreign office (1886-91) and postmaster-general (1891-2). Business affairs in 1907 drew him to Jamaica, where he was killed by the fall of a building during the earthquake of 14 January in that year. (P.C., 1868; K.C.M.G., 1874; C.I.E., 1880; G.C.S.I., 1885.)

Fern-bird. See SCRUB-WRENS.

Ferns. The fern-flora of Australia follows the flow of the recognized tropical and antarctic life-streams (see ZOOGEOGRAPHY), and shares in a still wider distribution, having Pacific and even European affinities. The richest fern-region of the Commonwealth is the tropical north-eastern area of Queensland.

In discussing ferns we must employ many technical terms that are unfamiliar to the flower-lover. Thus the plant itself is the spore-bearer or sporophyte, and a small film (prothallium), developed from the spore, is the gametophyte or bearer of the generative organs. The root of a fern is called the rhizome, the leaf-stem the stipes, and the leafy growth above the stipes the frond—whose divisions, if any, are successively pinnae, pinnules, and lobes or segments. The main rib of a frond is the rhachis; the rib of a pinna is the secondary rhachis; the ribs of the ultimate divisions are costae and costules. The spores are grown in a sporangium; a cluster of sporangia is a sorus; the sori are frequently

Sporangia of (a) *Polypodium*, (b) *Cyathea* (showing spores), (c) *Schizoea*.

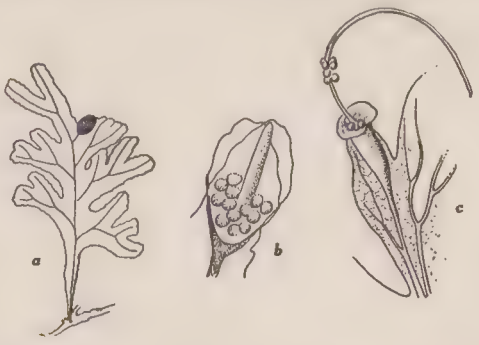
covered or surrounded by a membranous indusium. The part of a fern which carries the sorus is the receptacle.

The classification adopted in this article is as follows:—

Class I. FILICALES.
  Series i. Leptosporangiatae (each sporangium developed from a single cell).
    Sub-series 1. Eufilicineae (ferns proper).
      Families Hymenophyllaceae, Cyatheaceae, Polypodiaceae, Parkeriaceae, Gleicheniaceae, Platyzomataceae, Schizaeaceae, Osmundaceae.
    Sub-series 2. Hydropteridineae (water-ferns).
      Families Salviniaceae, Marsileaceae.
  Series ii. Eusporangiatae (each sporangium developed from a group of superficial cells).
    Families Marattiaceae, Ophioglossaceae.
Class II. LYCOPODIALES.
  Series i. Eligulatae, family Lycopodiaceae.
  Series ii. Ligulatae, family Selaginellaceae.
Class III. ISOETALES, family Isoetaceae.
Class IV. SPHENOPHYLLALES, family Psilotaceae.

This article deals with Class I only: for the other classes see LYCOPODIALES and PSILOTACEAE.

The main distinction of the Hymenophyllaceae (Filmy Ferns) lies in the nature of the receptacle, which is a hair-like development within a cup-shaped or vase-shaped indusium. The sporangia are sessile. There are two genera, *Hymenophyllum* and *Trichomanes*, the former having a more or less deeply two-valved indusium, the latter an indusium that is vase-shaped. The



(a) Frond and (b) fruit of *Hymenophyllum babindae*; (c) indusium of *Trichomanes venosum*.

surfaces of the sporangium in *Hymenophyllum* are composed of numerous regular cells, whereas in *Trichomanes* they are few and irregular. *Hymenophyllum* has about 15 known species, mainly in southern Australia, though a few

beautiful species have been recently added from the tropics. *Trichomanes*, on the other hand, is found chiefly in northern Queensland, where there are 25 species, but five or six of these extend into New South Wales.

Of the tree-ferns (Cyatheaceae) three genera are represented in Australia, *Dicksonia*, *Cyathea* and *Alsophila*. In *Dicksonia* the sorus is intramarginal at the apex of a vein, and the indusium two-valved, the outer valve consisting of a modified lobe of the frond. *D. antarctica*, a magnificent tree-fern, is common in the southern States and in New Zealand, and extends north to southern Queensland. *D. Youngiae* is found in the northern half of New South Wales, and as far north as the Bellenden Ker range in Queensland. *Cyathea* carries its sori at the back or at the forking of veins; the indusium is distinct and globose, quite enclosing the sorus when young, but afterwards bursting downwards irregularly and disappearing, or becoming more or less cup-shaped. *C. medullaris* and *C. Cunninghami* are found in Victoria and Tasmania. *C. Lindsayana* (from Mount Lindesay in Queensland) and *C. arachnoidea* (from Rockingham Bay in northern Queensland) have been collected once only. The globose sori of *Alsophila* occur on the backs or in the forks of veins: the indusium, in the few cases where it exists at all, is spurious and minute. This is the most characteristic Australian genus: *A. australis*, the southern species, extends well to the northwards; *A. Cooperi* and *A. Leichhardtiana* are of the central zone, the former reaching the tropics: *A. Rebeccae*, *A. Baileyana* (sometimes reckoned a variety of *A. Rebeccae*) and *A. Robertsiana* belong to northern Queensland. It is doubtful whether *A. excelsa* occurs in Australia, and *A. Loddigesi* is a doubtful species. No tree-ferns have yet been recorded from Western Australia.

By far the largest family of ferns is the Polypodiaceae, characterized by stalked sporangia with an incomplete vertical ring. The family includes twelve tribes—Woodsieae, Dryopterideae, Aspidieae, Oleandreae, Davallieae, Asplenieae, Blechneae, Pterideae, Vittarieae, Polypodieae, Acrosticheae, and Platycerieae.

The small tribe Woodsieae is represented in Australia by *Cystopteris fragilis* (Brittle Bladder-fern), found in cold regions in many parts of the world. The indusium is attached below the sorus and inflated over it. This little fern has been recorded from Tasmania, Victoria, and the Snowy Mountains in New South Wales.

The Dryopterideae, whose fronds somewhat resemble the leaves of an oak, include all ferns ascribed in Christensen's *Index* to the genus *Dryopteris*, both the indusiate and the ex-indusiate species. The genus *Dryopteris* in our classification includes indusiate species with free veins: *D. decomposita* is a typical species. *Nephrodium* includes indusiate species in which the veins are more or less united, especially alongside the midrib: typical species are *N. parasiticum* and *N. gongylodus*, the latter apparently the only *Nephrodium* that extends to South and Western Australia. *Phegopteris* has free veins, but the indusium is either absent or disappears early: typical species are *P. punctata* (which in Australia exists mainly as the variety *rugosula*) and *P. Queenslandica*, which extends over southern Queensland and northern New South Wales. *Goniopteris* resembles *Nephrodium* in venation, but has an early-disappearing indusium or none at all. All the species, including the handsome *G. urophylla*, belong to the tropical north. In *Meniscium*, which is represented in northern Queensland by the rare *M. triphyllum*, the veins unite, and the sori (which lack an indusium) are often confluent at the junction of the transverse veinlets: they are also known to run along the ex-current veinlets.

Nephrodium parasiticum.

The Aspidieae comprise the genera *Aspidium*, *Polystichum* and *Leptochilus*. *Polystichum* is characterized by free veins, a circular (rarely slit) indusium attached at the centre, and a coriaceous or sub-coriaceous texture. Typical species are *P. adiantiforme* (also known as *Aspidium capense*) and *P. aculeatum*, both widespread. *P. hispidum*, a beautiful species, is found in Tasmania and Victoria, and on Mount Wilson in the Blue Mountains of New South Wales. The indusium of *Aspidium* resembles that of *Polystichum*, but the veins are reticulated—that is, they form meshes (areoles), with free veins within the areoles. The only Australian species is the handsome *A. Mucllcri*. In *Leptochilus* the indusium is elongated along the rhachis, and sometimes overlaps it, the sori ultimately covering the underside of the fertile part of the frond; usually some fronds are fertile, others sterile. The three Australian species are tropical—*L. cuspidatus* has a wide tropical range, but *L. neglectus* and *L. Taylori* (which may be only a variety of *cuspidatus*) are indigenous to northern Queensland.

Polystichum aculeatum.

The Oleandreae comprise a single genus, *Oleandra*, with round sori and a reniform indusium; the sori are placed in a row near the base, or below the centre, of the compact free veinlets. The beautiful *O. neriiformis*, which has a wide tropical range, is found in northern Queensland.

In the Davallicae the indusium is attached at the bottom, or at bottom and sides (like a half-goblet or a swallow's nest), and open at the top; the sorus is at the apex of a vein. In *Nephrolepis* the pinnae are jointed to the rhachis, the fronds are not jointed to the rhizome, and the indusium is fastened at the base only. *N. exaltata* has been recorded from north-western Australia; *N. cordifolia* extends from the tropics well into New South Wales; *N. acutifolia* (also known as *Lindsaya lanuginosa*) is a beautiful fern with a wide tropical range that is found in the scrubs of northern Queensland. In *Hu-*

(a) *Nephrolepis cordifolia* (b) *Microlepia speluncae.*

mata the pinnae are not jointed to the rhachis, the fronds are jointed to the rhizome, and the indusium is fastened at the base only. *H. repens*, a widespread tropical fern, is found in the gullies of the Bellenden Ker range, where also *Leptolepia tripinnata* (whose fronds are not jointed to the rhizome) is endemic. In *Davallia* the indusium is attached on three sides, and the fronds are jointed to the rhizome. *D. pyxidata* is the common Hare's-foot Fern, extending from northern Queensland into Victoria; *D. dubia* (Mountain Bracken) occurs throughout Australia; tropical species are *D. denticulata*, *D. solida* and *D. epiphylla* (recorded from Cairns). *Microlepia* has the *Davallia* indusium, but the fronds are not jointed to the rhizome; *M. speluncae*, a widespread tropical species, occurs in northern Queensland. In *Dennstaedtia* the indusium is a bi-valvular flattened scale, the outer valve not belonging to the leaf-margin; the sori are submarginal at the base of the sinus. *D. davallioides*, a beautiful fern, extends from Tasmania to southern Queensland. In *Schizoloma* the sori are often confluent at the margin, and in the Australian species the nerves are reticulated: *S. ensifolium* occurs in northern Queensland in a bewildering diversity of forms. In *Lindsaya* the marginal or submarginal sori unite the ends of two or more veins, and the indusium is double, the outer valve consisting of the modified edge of the leaf-segment; in the pinnae the basi-scopic half is scarcely developed. This genus is represented in Australia by several delicate species, most found in northern Queensland—but *L. linearis* occurs in all the States.

Lindsaya linearis.

In the Asplenieae the sori are more or less elongated and linear, usually parallel with the side-nerves; the indusium opens lengthwise. *Athyrium* has fine-celled scales at the base of the stipes, short sori, one on a nerve, and an indusium often slightly curved and sitting on the nerve; *A. umbrosum*, a fern known in the islands of the Atlantic, occurs in the varieties *australe* and *tenerum*, which were described by Robert Brown under a separate genus *Allantodia*. The small *A. humilum* is found on the Ellenborough River west of Port Macquarie in New South Wales. In *Diplazium* sori occur two on a nerve, at least near the base of pinnules; its Australian species are mostly tropical, but *D. latifolium* extends southwards into New South Wales. In *Asplenium* the scales are strong-celled, the sori one on a nerve, and the indusium opens inwards: this genus is well represented in Australia. *A. bulbiferum* (Hen-and-chicken Fern) and *A. flaccidum* range from Tasmania into southern Queensland, *A. nidus* is the Bird's-nest Fern, and *A. adiantioides* is remarkably graceful. *Pleurosorus* lacks an indusium: *P. rutaefolius* (Rue Spleenwort) is widespread in extra-tropical Australia, especially among rocks and on dry ridges.

The Blechneae are closely allied to the Asplenieae, and F. O. Bower has proposed to make one family of the two: for the present, however, they may be treated as separate, the distinctive character of the Blechneae being that the sori are borne on a nerve-anastomosis parallel with the midrib. In *Blechnum* the sori are confluent and have an indusium; *B. cartilagineum*, with decurrent pinnae, is the typical species, and is common in the eastern States. *B. serrulatum* and *B. orientale* are northern, and *B. Whelani* is found in the Bellenden Ker range. All these have uniform fronds. In a section with dimorphic fronds (sometimes classed as a separate genus, *Lomaria*) the typical species are *B. Patersoni* and *B. discolor*, both found in most of the States. *B. capense*, which is variable and almost cosmopolitan, is frequently found with uniform fronds, and its variety *Gregsoni*, from the Mount Wilson district in New South Wales, is very rarely dimorphic. In *Stenochlaena* the confluent sori lack an indusium, and the fronds are di- or tri-morphic: the genus is represented in Australia by two fine climbing ferns, *S. palustris*—found in swamps and on the edge of lakes in northern Queensland—and *S. sorbifolia*, a pan-tropical species whose variety *leptocarpa* occurs in northern Queensland scrubs. The sori of *Doodia* are separate, in one or more rows. This genus comprises two well-defined groups, one with pinnatifid fronds, the segments towards the base being adnate to the rhachis, and the lowest pair occasionally free; in the other group the fronds are pinnate—at least in the lower half. To the first group belong *D. aspera*, widespread in Australia, *D. blechnoides* (which differs from *D. aspera* in having its lower pinnae less strongly shortened and its sori nearer the midrib), and *D. heterophylla* from the scrubs along the coastal railway line in southern Queensland. The second group is represented by *D. caudata*, which ranges from Tasmania to tropical Queensland.

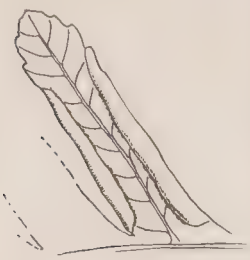
The Pteridеae include ferns that show a more or less wing-like arrangement of the sori. There are four sub-tribes, and further complicated subdivisions, but only the Australian species need be mentioned here. *Syngramma pinnata* and *Gymnopteris Muelleri* are found in northern Queensland: *Anogramma leptophylla* has been recorded from all the States except Queensland; *Gymnopteris Reynoldsi* is endemic near Mount Olga in the Northern Territory; *Peltaea falcata* (Sickle-fern) is widespread in Australia, growing usually in damp places, but in New South Wales and southern Queensland is often replaced by its variety *nana*, which grows among rocks. *P. paradoxa* is limited to New South Wales. The beautiful *Doryopteris concolor* is found in Queensland and northern New South Wales. *Notholaena distans* is hairy, *N. Browni* woolly; both range through all the States, as does *Cheilanthes tenuifolia*. *Hypolepis tenuifolia*, another widespread fern, is easily recognized by its solitary recurved marginal indusium. *Neurosoria pteroides*, which occurs in Queensland and the Northern Territory, is a

Anogramma leptophylla.

Peltaea paradoxa.

bipinnate form, with linear pinnae crowded with sporangia; the modified crenulate margins recurve until, in dried specimens, opposite edges often meet over the rhachis. *Plagiogyria euphlebia,* a widespread tropical species, has been recorded from Rockingham Bay in northern Queensland.

Two of the sub-tribes of Pterideae contain well-known ferns. The Adiantinae are the maidenhair ferns, all belonging to the genus *Adiantum*; *A. aethiopicum* is the cosmopolitan form, *A. formosum* the Giant Maidenhair, and *A. affine, A. hispidulum,* and the very delicate *A. diaphanum* occur in eastern Australia. *A. hispidulum* has also been recorded from the George Gills range in the Northern Territory. The Pteridinae include, besides *Histiopteris incisa* (found in all the States except Western Australia) and several species of *Pteris,* the cosmopolitan Bracken-fern (*Pteridium aquilinum*), which in Australia usually occurs in the variety *esculentum.* The Vittarieae are mainly tropical. Their sori are either



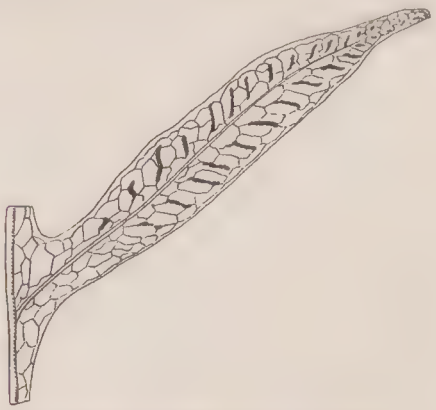
Pteris tremula.

marginal or carried on nerves more or less parallel to the midrib; the epidermis carries thick-walled spicular cells. Two species of *Monogramma* have been found in northern Queensland, *M. dareicarpa* in the Bellenden Ker range and *M. paradoxa,* var. *angustissima,* at Rockingham Bay and on the Atherton tableland. *Vittaria elongata,* a grass-like fern, ranges from northern Queensland into New South Wales; *V. wooroonooran,* a short-leaved species, occurs on Bellenden Ker. *Antrophyum reticulatum* and *A. callifolium* also occur in northern Queensland.

Polypodium Gordoni.

Antrophyum reticulatum.

An easily recognizable tribe is the Polypodieae, with roundish or elongated sori, no indusium, nervation pinnate, and stipes jointed to the rhizome. *Hymenolepis spicata,* with its unique tail-like sorus at the tip of the frond, occurs in northern Queensland. Of *Polypodium* there are several forms: in one—represented by *P. cucullatum* (Cowled Polypody), a rare tropical species—the upper pinnae which bear the sori are hollowed; in another the fronds are once divided, with pinnate nervation (most of the species are tropical, but *P. grammitidis* belongs to southern Australia); in a third (with two tropical species) the side-nerves are joined; in a fourth they are richly branched and form a close, irregular network—nearly all these species are tropical, but *P. Browni* extends from northern Queensland into New South Wales, and *P. scandens* and *P. pustulatum* (Scented Polypody) are southern ferns with a good range northwards. A fifth, characterized by simple fronds with free veins, is represented by *P. australe,* widely distributed, *P. Hookeri,* a tropical species covered with rich brown hairs, and *P. albosetosum,* found on Bellenden Ker. In *P. amplum,* which adorns tree-stems on the coast of northern Queensland, and *P. Selliguae,* found in a similar



Polypodium Selliguae (var. *Sayeri*).

position inland, the sori are more or less confluent, and form a continuous row parallel to the side-nerves. The genus *Cyclophorus* includes *C. serpens,* var. *rupestris, C. confluens, C. acrostichoides* (tropical), and *C. spicatus,* found in the Tambourine range in southern Queensland. *Drynaria rigidula* occurs throughout Queensland, and has been recorded from the Blue Mountains of New South Wales. *D. quercifolia,* a widely spread tropical species, is found in Australia only in the northern Queensland variety *sparsisora.*

The sporangia of the Acrosticheae occupy the whole under-side of the fertile frond. *Elaphoglossum conforme,* a pan-tropical species with (usually) undivided leaves, occurs rarely in northern Queensland. *Acrostichum aureum,* a worldwide tropical and subtropical fern, is found all over tropical Australia and in the north-coast swamps of New South Wales.

The last tribe of the Polypodiaceae, the Platycerieae, comprises certain well-known and dis-

tinct species. *Platycerium grande* (Staghorn) ranges from northern Queensland into New South Wales, and *P. bifurcatum* (Elkhorn) from mid-Queensland to southern New South Wales.

The Parkeriaceae are a small family represented in Australia by the unique *Ceratopteris thalictroides*, a denizen of tropical swamps. It has been found in north-western Australia and in Queensland, where its southern limit appears to be Moreton Bay.

In the Gleicheniaceae the sporangia open vertically and are surrounded by a broad transverse ring; there is no indusium. *Gleichenia linearis*, a pantropical species, has been found in New South Wales; *G. flagellaris* occurs in the eastern States as far south as Braidwood. In this genus F. von Mueller included Robert Brown's *Platyzoma microphyllum*, a tropical fern which has sorely puzzled systematists. Its long, narrow, pinnate leaves side by side with short filiform ones, and its broad, variable annulus (vertical, oblique, or horizontal, and almost always irregular and broken) make it so unique among ferns that we prefer to place it in a family by itself, the Platyzomataceae.

Platyzoma microphyllum.

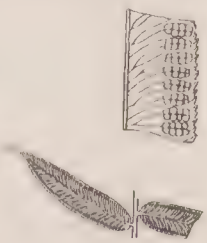
In the Schizaeaceae the sporangium is crowned by a ring like an operculum, which splits into two valves. *Schizaea* has bilateral spores, an upright rhachis, and leaves in several rows. In *S. rupestris* (limited to the neighbourhood of Sydney and the Blue Mountains) and *S. fistulosa* (found in all the southern States) the leaves are undivided: *S. bifida* occurs throughout the Commonwealth; *S. dichotoma*, a widespread tropical species, is found in the Northern Territory, Queensland and New South Wales, usually near the coast. *Lygodium* is a genus of climbing ferns, tropical and subtropical. *L. reticulatum* (known in Fiji as the God-fern) is plentiful in northern Queensland; *L. flexuosum*, also common there, is sometimes confused with *L. japonicum*, which probably does not exist in Australia; *L. scandens*, usually found in swamps, ranges throughout tropical Australia and has been found on the northern rivers of New South Wales.

In the Osmundaceae the sporangia open across the apex into two valves; the annulus is either lacking or very obscure. *Todea barbara*, widespread in Australia, is a large fern, thick-stemmed, with rigid light-green fronds; the pinnae stand at a sharp angle, the pinnules are decurrent, and the sporangia are densely clustered on the low pinnules and often cover them. *Leptopteris Fraseri*, probably the most delicately beautiful fern in Australia, is plentiful in the glens of the Blue Mountains, and ranges from the Clyde River in southern New South Wales to Bellenden Ker in northern Queensland; it is less robust than *Todea*, dark-green in colour, and its sporangia are smaller and fewer.

Of the water-ferns (Hydropteridineae) Australia has two families—the Salviniaceae, which are floating plants, and the Marsileaceae, which grow in marshy or inundated ground, to which their horizontal rhizomes are attached by means of rootlets. All these water-ferns have their sori at the roots, and the sporangia bear two kinds of spores—some yielding a single 'megasphore' which bears a female prothallium, others numerous 'microspores' from which come the male prothallia. The Salviniaceae are represented in Australia by *Azolla rubra* and *A. pinnata*, plants closely set with tiny leaves and with many true roots hanging down in the water. Of the Marsileaceae Australia has also two genera: *Marsilea Drummondi* is the well-known nardoo (q.v.), *Pilularia* has needle-like leaves. *P. novae-hollandiae*, the Australian form, has been sometimes confused with the European *P. globulifera*.

Marsilea.

The Marattiaceae include two genera of remarkable ferns in which the sporangia lie side by side in a boat-shaped sorus (synangium) and open by a slit down one side. In *Marattia* the synangium opens lengthwise and the sporangia are imbedded inside the two valves: *Marattia oreades is* found on Bellenden Ker, *M. fraxinea* (var. *salicina*) is plentiful in the coastal scrubs of northern Queensland. In *Angiopteris* the synangium opens crosswise, separating the sporangia by a thick wall; *A. evecta* is a magnificent tropical fern, sometimes 24-25 feet long and 13-14 feet across.



Angiopteris evecta.

The Ophioglossaceae are ferns whose sporangia grow in clusters on a special spike that springs from the sterile part of the frond; they are deeply two-valved, opening down the side almost to the base. *Ophioglossum pendulum* (Ribbon-fern) ranges from northern Queensland to the northern rivers of New South Wales; *O. vulgatum* (Snake's-tongue Fern) is found throughout Australia, but not in the typical form, so that some writers credit Australia with seven separate species. *Helminthostachys zeylanica* is rarely found in northern Queensland. *Botrychium ternatum* occurs in all the States except Western Australia; the Australian form was erected by Robert Brown into a separate species, *B. australe*. *B. lunaria* has been recorded from New South Wales, Victoria, and Tasmania.

Ophioglossum pendulum.

Besides the standard works by Labillardière, Brown, Hooker, Bentham, Christensen, Leuerssen, and D. H. Campbell, the following botanists have published handbooks on Australian ferns

or contributed papers about them to Australian scientific journals:—F. von Mueller, Domin, Moore, Maiden and Betche, Ewart, and Watts. Bailey has dealt with the ferns of Queensland, Turner with those of New South Wales, Pitcher with those of Victoria, Rodway with those of Tasmania, and Tate with those of South Australia. W.W.W.

Fever-bark. See ALSTONIA.

Fiddler. See SHOVEL-NOSED RAY.

Field, BARRON (1786-1846), born in London on 23 October 1786, probably educated at Christ's Hospital, trained for the law and called to the bar at the Inner Temple on 23 June 1814, had by that time made himself a small reputation among the literary companions of Charles Lamb and Leigh Hunt; he was also theatrical critic of *The Times*, and a contributor to the *Quarterly Review*. His career at the English bar was short and unsuccessful, and in 1816 he applied for and obtained a position as judge of the supreme court of New South Wales in succession to Jeffery Bent (q.v.). Reaching Sydney on 24 February 1817, he administered justice there until 4 February 1824; then he returned to England on a pension of £400 a year, and obtained the position of advocate-fiscal (i.e. crown prosecutor) for Ceylon, and dropped it in February 1829 to take the chief-justiceship at Gibraltar. In 1835 he resigned, returned to England once more and abandoned the law altogether, dying at Torquay on 11 April 1846.

Of Field's legal career little need be said. At the outset of it Macquarie took a great fancy to him and praised his 'mild, modest and conciliating manners,' and Biggs approved his conduct of affairs whole-heartedly; but he came into collision with Brisbane over the appointment of John Macarthur to the magistracy and over the Douglass case, and in 1824 Brisbane accused him of official discourtesy, slander, and making himself 'the head of a faction . . . . who seemed guided by no moral restraints in order to accomplish their ends.' Field's recall, while obviously caused by the necessity of entrusting the new supreme court (created by the act of 1823) to a lawyer of great ability and learning, may have been also partly due to the incessant friction between him and the governor. Of his term at Gibraltar nothing is known except that Disraeli in his Beau Brummell stage considered him 'noisy, obtrusive, jargonic'—an exaggerated form of the verdict frequently passed by conceited young men on elders perhaps rather too fond of laying down the law.

But Field's chief claim to remembrance lies in his writings, not so much for their intrinsic value as because one section of them pioneered Australian literature and science, and another forms no inconsiderable part of the critical literature inspired by Charles Lamb. Unfortunately he began his Australian work with the publication of a slim volume of verse, of which the less said the better for his credit—though he was proud of it, issued two editions in New South Wales (1819 and 1823), and republished the second edition in London as part of his *Geographical Memoirs on New South Wales* (1825). This was a collection of articles some of which he had originally written for the *London Magazine* during 1822-5. Not all were Field's, but he must have the credit of first publishing Oxley's report of his Moreton Bay voyage, Pamphlett's of his shipwreck, Allan Cunningham's of his discovery of Pandora Pass, and several monographs on the geology, botany, meteorology, ethnology, and maritime geography of New South Wales, and the astronomy of the southern hemisphere, all by the recognized local authorities on their subjects. It is unjust to the zealous and patriotic editor of these memoirs to remember him solely by a dozen pages of poor verse. Field also wrote a preface for the *Memoirs* of Hardy Vaux (q.v.). After his return from Gibraltar he devoted himself mainly to the study of Elizabethan drama, editing five plays of Heywood's between 1842 and 1846; he wrote a good memoir of Charles Lamb (1836), and wanted to write a *Life* of Wordsworth, but the poet would not allow it. Lamb reviewed his verse in the *Examiner*, addressed to him the essay 'Distant Correspondents,' and embalmed him as B.F. in 'Mackery End.' W.J.

Field-lark. See WARBLERS.

Field-wrens. See GROUND-WRENS.

Fig, the popular name of several species of *Ficus*, a large genus of the family Urticaceae, widely spread over the tropical and subtropical regions of the world, but most abundant in Malaysia. Sixty species are indigenous to Australia, chiefly to its eastern areas; but *F. platypoda* extends to Western Australia, and *F. orbicularis* is found in South Australia. *F. rubiginosa* (Port Jackson or Illawarra Fig—also Rusty Fig, from the colour of the under-side of its leaves) and *F. macrophylla* (Moreton Bay Fig) are useful fodder-plants, cattle and horses eating the twigs, leaves, and fruit with zest; the aborigines eat the fruit, and use the fibre obtained from the roots—which is very durable—to make their scoop fishing nets. Both these species are often planted as ornamental trees to provide shade or form an avenue. *F. rubiginosa* is found chiefly in the coastal districts, but extends as far west as Narrabri and northward into Queensland. These trees often develop huge projecting buttresses at the base, whose interspaces are sometimes ingeniously converted by settlers into shelters for animals. In brush forests the figs may originate either from seed or from the aerial roots of another fig, which attach themselves to the bark of a neighbouring tree. It is not uncommon to see a huge tree completely enveloped in these aerial roots, the fig finally strangling its host and taking its

Port Jackson Fig.

place. *F. macrophylla* extends from the northern rivers of New South Wales into Queensland. *F. glomerata* (Clustered Fig) extends from Queensland and northern Australia to India; it is a large tree, with fruits which hang in clusters, red when ripe, along the trunk and limbs, and are used as a food by natives in both Australia and India. *F. Henneana* is known as the Deciduous Fig; but the trees are bare for a few weeks only, the new leaves showing very soon. The ripe fruits are ornamental, red to purple, spotted with white. This species, originally described from specimens collected at Booby Island in Torres Straits, was found in 1902 on the banks of the Port Hacking River in New South Wales. It is a handsome tree, easily propagated from seed. *F. stephanocarpa* (Rough-leaved Fig) is a slender tree (15-25 feet) ranging from southern New South Wales into Queensland; it is the 'noomaii' of the Rockhampton aborigines, who eat the fruits—which turn black when ripe. In Fiji the leaves of this species are used for serving food, and in the Clarence River district of New South Wales as a substitute for sand-paper. *F. platypoda*, a small but robust tree, has edible fruits which explorers have described as very good. It has a soft, strongly fibrous wood. *F. columnaris* is the Lord Howe Island 'banyan;' old specimens cover large areas with a succession of aerial roots that penetrate the ground.

Fig-birds, perching birds about the size of thrushes, of the genus *Sphecotheres*, peculiar to northern and eastern Australia, New Guinea, the Papuan islands, and Timor. They have usually been placed in the oriole family (Oriolidae), but by some ornithologists are considered to be more nearly related to the cuckoo-shrikes (Campephagidae). Mathews has recently created for them a special family Sphecotheridae.

Yellow-breasted Fig-bird.

The plumage differs in the two sexes, the males being yellowish-green above, with black heads, wings and tails, and yellowish underparts; the females are brown above and whitish below, streaked with brown. In both sexes there is a patch of bare skin round the eye, extending forward to the bill, coloured bright scarlet in males and purplish-grey in females. The common Fig-bird (*S. vieilloti*) is plentiful in the coastal districts from Newcastle to Cairns; the Yellow-breasted Fig-bird (*S. flaviventris*) is found along the northern coast of the continent.

Fig-birds are forest-haunting birds, feeding on scrub fruits, especially those of fig-trees. They associate in small flocks, and when feeding utter loud and curious calls. Their nests are very slight structures of twigs, usually built in the fork of a horizontal branch near its extremity. The eggs vary from light-green to brown, and the reddish-brown markings upon them are also variable.

W.B.A.

Filices. See FERNS.

Filmy Ferns. See FERNS.

Finches, perching birds belonging to the families Fringillidae and Ploceidae. The former family is represented in all parts of the world except the Australian region; but since European settlement took place several of its members have become acclimatized in Australia—principally about Melbourne and Sydney, from which centres the majority are gradually spreading northwards and westwards. The House Sparrow (*Passer domesticus*, see NOXIOUS BIRDS) is the only species which has reached Queensland; none have yet succeeded in establishing themselves in Western Australia. In South Australia both the sparrow and the Goldfinch (*Carduelis carduelis*) have become common, and the goldfinch is also acclimatized in Tasmania. In Victoria and New South Wales the Greenfinch (*Chloris chloris*) and Tree Sparrow (*Passer montanus*) are also established.

The indigenous finches of Australia belong to the family Ploceidae, members of which are also found throughout the Malay Archipelago and southern Asia, as well as in Africa, where they are specially numerous. They are usually distinguished as weaver-finches or weaver-birds.

Weaver-finches feed principally on small seeds, especially grass-seeds, their conical, rather stout beaks being adapted for husking grain. Many species occur in very large flocks in those parts of northern Australia where there is a plentiful supply of grass. Their notes consist mainly of chirpings and twitterings; they are not songsters like many of the true finches (Fringillidae). Their nests are bulky, untidy structures of grass, domed, with the entrance at the side, placed in bushes. They lay five or more pure white eggs.

Owing to the bright colours with which they are mostly adorned, and the ease with which they can be captured and kept alive in cages, our finches are favourite birds for aviaries, and thousands are trapped annually in northern Australia for shipment to all parts of the world. Unfortunately a very large proportion die on the journey. Their numbers have become so much reduced from constant trapping in the more accessible districts that the Queensland government has prohibited their capture and export.

Of the 20 species found in Australia and Tasmania, the great majority are confined to the north and north-east of the continent, some of them appearing at times on the inland plains

of the southern States when the grasses are in seed. Four species are peculiar to the southern parts of the continent, all of them brown birds with brilliant scarlet colouring on the base of the tail—whence they are frequently known as fire-tails. The Spotted-sided Finch (*Staganopleura guttata*) and Red-browed Finch (*Aegintha temporalis*) are confined to south-eastern Australia, the Fire-tailed Finch (*Zonaeginthus bellus*) is found in the south-east and in Tasmania, the Red-eared Finch (*Z. oculatus*) is limited to the extreme south of Western Australia.

Of the northern forms, familiar to most Australians as cage-birds, the following are the best-known:—the Chestnut-eared or Zebra Finch (*Taeniopygia castanotis*); the Red-faced or Star Finch (*Bathilda ruficauda*); the Crimson or Blood Finch (*Neochmia phaeton*); the Masked Finch (*Poëphila personata*) and the Gouldian or Painted Finch (*P. gouldiae*). The alternative names in each case are those used by dealers and fanciers. The name 'painted finch' is applied by ornithologists to the rare *Emblema picta* of central Australia.

P. gouldiae is the most strikingly coloured of all our finches. Its head is black, margined with cobalt blue all round; its back green, with a patch of blue on the rump; its breast lilac; and its under-parts golden-yellow, with a patch of white under the tail. It was named by John Gould (q.v.) in memory of his wife. It is also interesting because in some individuals the black on the face becomes replaced by bright scarlet when they are a few years old, in others the black mask is retained throughout life. The scarlet-headed birds were at one time thought to constitute a distinct species. W.B.A.

Finn, Henry (1852-1924), born at Tenterden in Kent on 6 December 1852, in 1871 enlisted in the 9th Lancers and with them served in the Afghan war of 1878-80, gaining the D.C.M. In 1881 he was commissioned 2nd lieutenant in the newly formed 21st Hussars (captain, 1887; major, 1894; lieutenant-colonel, 1900; colonel, 1907; brigadier-general, 1912), and served on the staff of the Madras army as D.A.A.G. (1893-5) and A.A.G. (1895-8). In 1898 his regiment was converted into lancers, and he accompanied it to the Sudan and took part in its famous charge at the battle of Omdurman. In 1900 he left the regiment to become commandant of the military forces in Queensland, in 1902 was transferred to New South Wales, and in 1905 succeeded General Hutton (q.v.) as inspector-general of the military forces of the Commonwealth, with the local rank of major-general. He had worked loyally under Hutton through the difficult reorganization of six State forces into a single Commonwealth force, and carried on the process ably, but was forced for reasons of health to retire from the army in 1907. For a few years he engaged in commerce, but in 1912 was made secretary of the Walter and Eliza Hall trust, and in 1913-17 was private secretary to Sir Gerald Strickland during his governorship of New South Wales. In 1923-4 he was private secretary to the acting-governor, Sir William Cullen. He died after a short illness on 24 June 1924. Both as a man who had risen from the ranks and as a disciplinarian Finn had an excellent influence on the young and inexperienced troops he handled in Australia: he steadily encouraged promotion from the ranks, and at the same time persistently enforced the necessity of taking military training seriously. (C.B., 1907.)

Finniss, Boyle Travers (1807-1893), was born at sea on 18 August 1807, educated at Greenwich and at the royal military college, Sandhurst, and entered the British army in 1825 (ensign, 1825; lieutenant, 1827), but sold his commission in 1835 in order to migrate to New South Wales. However, having been appointed assistant to Colonel Light, the first surveyor-general of South Australia, he accompanied that official to Adelaide in 1836, and during the next 16 years rose steadily through the public service (deputy-surveyor-general, 1839; commissioner of police, 1843; treasurer and registrar-general, 1847) till in August 1852 he became colonial secretary—a position he had already held temporarily during Sturt's absence in 1849. As colonial secretary he carried through the council the first constitution act (which did not receive the royal assent) as well as the final act, and in 1854-5 was acting-governor for about six months. In October 1856 he became first premier of the colony under the responsible-government regime, but resigned in August 1857 after a good deal of friction with Sir R. MacDonnell. In the following June he became treasurer in the Hanson ministry (1858-60), and for the next two years represented Mount Barker in opposition. In 1864 he was appointed first government resident for the Northern Territory, and led an expedition to establish the main settlement at Escape Cliffs on Adam Bay, about 30 miles north of Darwin; but both the choice of site and the conduct of the expedition proved unsatisfactory, and in 1865 Finniss returned to Adelaide, resigned, and retired into private life. In 1875 he was appointed a member of the forest board, resigning in 1881, and devoting himself to the compilation of a *Constitutional History of South Australia*, which was published in 1886. He died on 24 December 1893.

Finniss is often styled 'lieutenant-colonel,' this rank having been conferred on him by an act of the local council in 1854, when for fear of Russian privateers the colony was raising a volunteer defence force of 2000 men. The unsettled state of the world in 1860 caused this force to be revived, and Finniss (who raised a company known as the 'Adelaide Marksmen') was given command of the 1st Adelaide regiment.

Fire-tail. See Finches.

Fire-tree. See Stenocarpus.

First Fleet, The. This article describes the organization, departure, and outward voyage of the first expedition that took convicts to New South Wales—ever since its arrival known as the 'First Fleet'—which was brought into being by a letter from Lord Sydney (then at the home office) to the lords of the treasury, dated 18 August 1786, which set forth the King's pleasure that ships should be provided for carrying '750 convicts to Botany Bay with such provisions, necessaries, and implements for agriculture as may be necessary for use after their arrival.' Upon this instruction were set to work the admiralty, which was responsible for the equipment and officering of the ships, and for the marine guard in the transports; the victualling department, for the provisions; the transport department, for the convict transports; the treasury, for the financial arrange-

FINCHES

Plate XV

Drawn by Neville W. Cayley.

1. Red-cared Finch (*Zonaeginthus oculatus*).
2. Red-faced (Star) Finch (*Bathilda ruficauda*).
3. Painted Finch (*Emblema picta*).
4. White-breasted Finch (*Donacola pectoralis*), male and female.
5. Fire-tailed Finch (*Zonaeginthus bellus*).

ments; and a number of sub-departments. The East India Company also played a part, owing to its monopoly of trade to the East, for three of the transports were under charter to take cargoes of tea from China to London after landing convicts and stores in New South Wales. An enormous amount of correspondence was involved in the preparation which, beginning with the above letter, only ceased on 11 May 1787, when Arthur Phillip (q.v.)—who had been appointed to command the expedition, with the rank of commodore—sent his last despatch on the eve of sailing from Spithead.

In charge of the expedition was H.M.S. *Sirius*, commanded by Phillip in person, with John Hunter as second captain. The *Sirius*, originally named *Berwick*, was built on the Thames in 1781. She was classed as a sixth-rate, and armed with six carronades and four 6-pounders mounted—an armament less than that usually carried in a ship of her size. Ten 6-pounders, with iron-work for building the gun-carriages, were carried in her hold, to be used if required in the settlement. Her burthen was 520 tons, her dimensions about 100 feet by 32 with 12 feet depth of hold: it may assist some readers to conceive her as smaller than the small North Sydney ferry-boats, with a tonnage less than that of the larger Manly ferry steamers. The principle of construction was, of course, entirely different. The tonnage of the whole fleet taken together—3892 tons—was barely half that of the average coastal passenger steamer nowadays plying between Australian ports.

The *Supply*, an armed tender, was the other King's ship, a poor sailer and too small for the work. She was a brig-rigged sloop of 170 tons, commanded by Lieutenant Henry Lidgbird Ball, and carried eight 3-pounder guns and 50 men. The transports were the *Alexander*, Duncan Sinclair master, 452 tons; *Lady Penrhyn*, William C. Sever master, 333 tons; *Charlotte*, Thomas Gilbert master, 335 tons; *Scarborough*, John Marshall master, 430 tons; *Friendship*, (snow), Walton master, 274 tons; *Prince of Wales*, John Mason master, 350 tons. The storeships were the *Fishburn*, R. Brown master, 378 tons; *Golden Grove*, Sharp master, 375 tons; *Borrowdale*, R. Hobson master, 275 tons; making a fleet of two King's ships, six convict transports, and three storeships. The contract with the private ships was at the rate of 10s. per month per ton until their return to Deptford—except in the case of the *Lady Penrhyn*, the *Charlotte*, and the *Scarborough*, which when cleared in New South Wales ended their contract and began a new one with the East India Company. The other three transports and three storeships were to return to England in charge of Lieutenant J. Shortland (q.v.), agent for the transport department. The contracts for the most part were carried out through William Richards, a shipbroker of Walworth. The owners and masters of the vessels were supplied with warrants to 'secure and keep in safe custody' the prisoners, and entered into bonds to do so. Richards also contracted to supply the provisions, which were to be at the rate of two-thirds the allowance to seamen in the navy, and Zachariah Clarke was sent out in one of the ships to see to the contractor's interests. The transports were fitted for convicts as they would have been for troops, with hammocks, mess tables, and stools; but thick bulk-heads three feet high, studded with nails, were run across between decks from side to side abaft the mainmast, with loopholes to fire through in case of mutiny. This also prevented communication between the ship's company and the convicts and their guard. The hatches were secured with cross-bars, bolts and locks, and railed round from deck to deck with oak stanchions. Sentries were stationed at each, and a guard, always under arms, was kept on the quarter-deck to prevent any sudden outbreak. It was fortunate that nothing of this kind occurred; for among the few things forgotten by the authorities was ammunition for the guard, whose only supply was obtained from the small arms magazine on board the *Sirius*.

The food and water supply for the long voyage was a serious problem. It concerned about 1480 persons, most of whom were totally unaccustomed to sea life, unhealthy in every sense of the word, and highly receptive of such diseases as scurvy and the disorders that arise from close confinement and poor living. The voyage, moreover, was to end with their arrival in a country remote from help, affording neither food nor shelter, inhabited, for all they knew to the contrary, by a savage race and infested by wild beasts. The supply of food and water was, fortunately, plentiful, good and (incredible as it may seem) both in quality and quantity superior to that often served to merchant seamen in British sailing-ships down to very recent times. The official ration of water was three quarts per day per man; the food scale two-thirds, as already mentioned, of that fixed for the naval service—which was, per week per man, bread (i.e. biscuit) 7 lb., salt pork 2 lb., salt beef 4 lb., peas 2 lb., oatmeal 3 lb., butter 6 lb., cheese ¾ lb., vinegar ½ pint. The scale was not adhered to, the whole ration being largely increased, and varied by rice, portable soup, and dried fish. When in port, and as long after as the stock of fresh provisions lasted, fresh meat and vegetables in plenty were supplied. The ration was increased up to 20 oz. of meat and 1 lb. of rice per day in ports where these foods were cheap. The women and children were given a special diet, and the sick allowed wine and spirits. The prisoners were supplied with hammocks and blankets, and clothing for the year, consisting of two jackets, four pairs of woollen drawers, one hat, three pairs of worsted socks, three frocks, three pairs of trousers, and three pairs of shoes; and the women with suitable apparel. During the voyage the water ration sometimes had to be reduced; but not for long, as the supply was nearly always sufficient to last between ports and was, of course, renewed whenever rain fell. Some notion of the quantity of food necessary to be carried, not only for the voyage but to supply the settlement after landing, can be gained from documents showing the state of the stores at Sydney in September 1788, on which 933 persons were to be victualled:—flour 414,176 lb., 52 weeks' rations; rice 51,330 lb., 15 weeks' rations; beef 127,608 lb., 43 weeks' rations; pork 214,344 lb., 128 weeks' rations; peas 2305 lb., 58 weeks' rations; butter 15,450 lb., 49 weeks' rations.

The ships' decks were crowded with pens containing sheep, hogs, goats, puppies, kids, turkeys, geese, ducks, chickens, pigeons, and cats. More live stock, as well as seeds, were taken on board at the Cape of Good Hope—one bull, one bull-calf, seven cows, one stallion, three mares and three colts, 44 sheep, four goats,

28 boars and breeding sows; and the officers bought such private stock as room could be found for in the different ships. The following plants and seeds were procured:—at Rio de Janeiro coffee (seed and plants), cocoa beans in the nut, cotton-seed, bananas, oranges, lemons, tamarinds, guava-seed, prickly pear (plants, with the cochineal on them), 'eugenia or pomme rose,' jalap, and three sorts of ipecacuanha; at the Cape fig-trees, bamboos, sugar-cane, 'Spanish reed' (possibly esparto grass), vines, quinces, apples, pears, strawberries, oaks, and myrtles, besides rice, wheat, barley, maize, and other grains. Both at Rio and at the Cape Phillip bought sheep on government account, but the cost and bulk of their fodder made it impossible to bring along many. The officers, realizing that for some years their future abode would be almost completely cut off from civilization, brought with them much furniture and clothes and some luxuries: the surgeon of the *Sirius*, for instance, brought out a piano, which he left with the Macarthurs when he returned to England in 1791.

Naval and marine officers, naval surgeons, and four civilians constituted the governor's staff. As most of them are referred to under other headings, and many under their proper names, it is only necessary here to give a list of the establishment: governor-in-chief, Arthur Phillip; lieutenant-governor, Robert Ross (also major commanding marines); chaplain, Richard Johnson; judge-advocate, David Collins (a captain of marines); surveyor-general, Augustus Alt; commissary of stores, Andrew Miller; assistant commissary, Zachariah Clarke; provost-marshal, Henry Brewer (Brewer was a midshipman in the *Sirius* and was appointed on the voyage out, as George Alexander, who had been given the position, resigned at the last minute before sailing); peace officer and bailiff of the government, James Smith. Lieutenant George Johnston of the marines acted as aide-de-camp to the governor, and Lieutenant William Dawes of the marines as engineer and artillery officer. The hospital establishment was—surgeon-general, John White; first assistant, Dennis Considen; second assistant, Thomas Arndell; third assistant, William Balmain. The naval establishment was—H.M.S. *Sirius*: Captain, Arthur Phillip; second captain, John Hunter; lieutenants, William Bradley, Philip Gidley King, and George William Maxwell. H.M.S. *Supply*: Lieutenant Henry Lidgbird Ball, commander. There were also surgeons Bowes and Alltrees in the transports; surgeon G. B. Worgan and surgeon's mate Thomas Jamison in the *Sirius*; and surgeon Callan in the *Supply*. For the voyage all surgeons were under the surgeon-general. There were four companies of marines, which included one major, two captains, two captain-lieutenants, nine first lieutenants, four second lieutenants, one adjutant, one quartermaster, one judge-advocate, 12 sergeants, 12 corporals, eight drummers, and 160 privates. The captains were:—James Campbell, John Shea, David Collins (judge-advocate); captain-lieutenants (a rank since abolished) James Meredith, Watkin Tench; first lieutenants, James Maxwell, John Creswell, John Poulden, James M. Shairp, John Johnston, George Johnston (aide-de-camp), Robert Kellow, Thomas Davey, Thomas Timins, and James Furzer, quartermaster. The second lieutenants were William Dawes (engineer and artillery officer), Ralph Clarke, William Faddy, William Collins (brother of the judge-advocate), and John Long, adjutant. John Ross, son of the major, was a volunteer without pay, and there were 28 wives and 17 children belonging to the men of the detachment. The crew of the *Sirius* numbered 160 men; of the *Supply* 50 and the transports and storeships had crews varying from 30 in the largest to 22 in the smallest, with a total of 233.

Lieutenant Watt, R.N., was a passenger by the *Lady Penrhyn* on his way to China. Many of the junior officers of the *Sirius* and *Supply* afterwards came into prominence in the work of the settlement. The purser, John Palmer, became commissary; Henry Waterhouse, Newton Fowell, and Daniel Southwell, mates and midshipman, won their promotion on the station. Merton, master of the *Sirius*, and two midshipmen were invalided home from Rio de Janeiro. James Keltie, who had served as a master in the navy, but was acting as mate of the *Fishburn*, was appointed master in the *Sirius*, and in that capacity had much to do with the survey of Sydney Harbour. A midshipman, Francis Hall, disappeared—lost, it was supposed, in the bush on the shores of Port Jackson—in November 1789, and was never afterwards heard of. Ross, the gunner of the *Sirius*, died on his way home. Donovan, midshipman, and Brooks, boatswain, were largely employed in boat work at Norfolk Island, and became expert pilots for its dangerous coast. The three Shortlands in the fleet are referred to under their names. David Blackburn, master, and Robinson Reid, carpenter, of the *Supply*, were highly commended for their work by Phillip.

Authorities disagree curiously concerning the number of prisoners. Collins gives 756, Tench 757, Phillip's *Voyage*, 778, Hunter's *Voyage* 800; and each of these accounts varies the number in different parts of the same book. A transportation office return, dated 13 June 1794, gives the number as 778; this agrees with a return of the house of commons select committee on finance, dated 26 July 1798, and approximates to the figures given in the appendix to Phillip's *Voyage*, which supplies a list of names, places of conviction and sentences, making a total of 780, and to a return sent from Santa Cruz by Phillip, dated 10 June 1787. The latter document is probably the best authority, as it was made out when the fleet had been long enough at sea to have the accounts in order. The return is as follows:—marines, including officers, 197; marines' wives, 28; marines' children, 17; chaplain and wife, 2; surveyor-general, 1; surgeon and assistants, 5; servants, 2; men convicts, 558; women convicts, 192; children, 13; convicts dead since embarking, 21; convicts' children dead since embarking, 3; received King's pardon before the fleet left, 2. This gives a total of 789 convicts and their children embarked, of whom 2 were pardoned; the fleet therefore sailed with 771 prisoners and 16 children of convicts. Add to this 252 guards and officials, 210 seamen of the navy, and 233 merchant seamen, and we reach a grand total in the fleet of 1482 persons.

The *Charlotte* and *Friendship*, transports, took on board their prisoners at Plymouth, the other ships at Deptford and Spithead, where the whole fleet was ordered to rendezvous. The ships assembled on 17 March 1787. H.M.S. *Hyaena* under Captain Michael de Courcy joined the squadron on 12 May to escort it to sea. Some insubordinate seamen on the transports were removed to the *Hyaena*, and volunteers from

her took their places. Little notice was taken of the ships as they lay in sight of Portsmouth and the Isle of Wight, fleets of 200 or 300 sail being then by no means uncommon when the West India convoy was waiting for a fair wind down channel. Newspapers were not numerous, and were full of the trial of Warren Hastings, or the morganatic marriage of the Prince of Wales and Mrs. Fitzherbert. Two or three lines, to the effect that the fleet destined for Botany Bay had departed, is all the mention made of it in the press. But two private references to the sailing are still extant. The minister of a church in the Isle of Wight recorded in his diary that, as the convoy left Spithead, he prayed for its safety and for the souls of the prisoners. And an anonymous officer, writing in the *United Services Journal* for December 1846, described the embarkation of convicts at Portsmouth:

> I recollect perfectly all the shop-windows and doors of Portsmouth being closed on this occasion, and the streets lined with troops while the waggons—I think 30 in number—passed to Point Beach, where the boats were ready to receive them. As soon as they were embarked, they gave three tremendous cheers, and were rowed off to the transport ready for their reception at Spithead.

At daybreak on the morning of 13 May the fleet passed through the Needles. The ships were three days clearing the channel, and on 20 May hove to about 200 miles west of Scilly and sent letters and despatches by the *Hyaena*. On 3 June the fleet arrived off Teneriffe, anchoring in Santa Cruz roads, about a mile from the town. By this time warm weather and tropical rains necessitated strict enforcement of health regulations. The passengers were not allowed to get wet; explosions of gunpowder between decks, and a liberal use of oil of tar and lime, sweetened the ships. The problem of ventilation was doubly difficult in the female convict transports, as it was found absolutely necessary to keep the women locked up below at night to prevent intercourse with the guard and the seamen. Although windsails were rigged, the heat below was so great that women were continually fainting. On 6 July it became necessary to put everyone, without exception, on three pints of water per day, exclusive of cooking, for which one quart per man was allowed; this shortage of water soon brought on symptoms of illness, although the diet had been improved by catching a great number of fish. The equator was crossed on the evening of 14 July, but no ceremony of any kind was observed. So far the fleet had had moderate to fine weather; but on 23 July the wind increased, and during the ensuing three days some of the ships lost a few light spars in heavy squalls. On 4 August the fleet anchored in the harbour of Rio de Janeiro, and on the following day, at the invitation of the viceroy, came farther up the bay and anchored a mile and a half from the landing-place. Don Luiz de Varconcellos, viceroy of the Brazils, received Phillip and his officers with great kindness, remembering that Phillip, who spoke Portuguese well, had served with distinction in the navy of his sovereign. During the month the ships spent in port they were supplied at reasonable charges with everything needed. On 4 September the fleet got under way again, and on 13 October, at seven in the evening, reached Table Bay and anchored a mile and a half from the shore. The Dutch governor, Mynheer van Graaf was polite but unhelpful, explaining that the colony was short of provisions, and was not in a position to sell all that would be required, except at high prices. However, negotiations resulted in Phillip's obtaining sufficient to serve out 1½ lb. of fresh meat and a like quantity of soft bread per day to everyone in the fleet during its stay. Live stock was also obtained. On 13 November the ships were under way again. On 25 November Phillip, taking with him P. G. King and Dawes, changed his pennant to the *Supply*, and with the three best sailers in the fleet (the *Alexander*, *Scarborough*, and *Friendship*) went on ahead to make preparations for the landing, leaving Hunter in charge of the other ships. The two squadrons lost sight of each other the following evening. At early morning on 7 January 1788 the *Lady Penrhyn* signalled land in sight, and at 4 p.m. that day they sighted the Mewstone, near the South Cape of Tasmania—at that time believed to be the southernmost point of the Australian continent. Hunter did not make the land until he sighted Red Point (so called by Cook—really one of the Five Islands near Wollongong) on 19 January. Next day they entered Botany Bay, and were at anchor at 8 a.m. The *Supply* was only 40 hours ahead of them, and the three transports that had been detached with her only 20.

The voyage had taken eight months and one day, and the distance sailed was 15,063 miles. The ships had not, except by design, lost sight of each other for an hour, although nine of them were small merchantmen, and the greater part of the sailing was in unknown waters. Add to this that the death-rate was very low, although the ships were crowded to an extent incredible in the present day, and the people on board belonged to the most difficult and unhealthy class of passengers, many of them having left England in a very sickly state—and the success of this remarkable voyage can be appreciated. The officers of the fleet attributed much of the success of the voyage to the good quality of the provisions.

See Collins's *Account of New South Wales* (London, 1798); Phillip's *Voyage* (London, 1790); Hunter's *Historical Journal* (London, 1793); Tench's *Narrative of the Expedition to Botany Bay* (London, 1789); White's *Journal of a Voyage to New South Wales* (London, 1790); Gilbert's *Voyage from New South Wales to Canton* (London, 1789); *The Historical Records of New South Wales*; Bradley's journal and other mss. and pamphlets in the Mitchell Library, Sydney; contemporary newspapers and periodicals; and the log-books of some of the transports.

W.J.

Fisher, ANDREW, born at Crosshouse in Ayrshire, Scotland, on 29 August 1862, worked in the local collieries from the time he was 10 years of age until in 1885 he migrated to Queensland. There for eight years he worked on the Burrum coal-field and at the Gympie diggings. At Gympie he made himself a prominent member of the then just-born Labour party, and in 1893 was elected for that constituency to the Queensland assembly; he lost the seat in 1896, but regained it in 1899, and became minister of public works in the extremely short-lived cabinet of Anderson Dawson (q.v.). Wide Bay returned him to the first federal house of representatives in 1901, and continued to do so until he left politics altogether in 1915. Making his name as a slow-moving but upright and hard-headed politician, he was taken

into Watson's first Labour ministry as minister for trade and customs, became deputy-leader of the party when it went into opposition, and when Watson was forced by ill-health to resign in 1907 succeeded him as leader. For a time he supported the Deakin ministry, but in November 1908 withdrew his support, drove Deakin from office, and himself became prime minister and treasurer. Defeated in the house in June 1909 by a parliamentary combination of Deakin's and Cook's followers, he was returned at the head of a good majority at the elections of 1910, formed his second ministry, and was responsible within the next three years for the transfer of the Northern Territory to the Commonwealth; the establishment of the Commonwealth Bank (q.v.) and the issue of bank-notes by the federal treasury, superseding all private bank issues; the imposition of a federal land tax, the construction of the transcontinental railway (east-west) and the creation of the inter-State commission. He was also largely responsible for the creation of the Australian squadron (which he initiated during his 1908-9 term with the building of destroyers), and the development of the compulsory training military system; but these matters were on the whole outside party politics, and the Deakin ministry of 1909-10 and that of Cook in 1913-4 had also an important share in the complete organization of Australian defence, the first in particular being responsible for accepting the 'unit' scheme for the squadron and Lord Kitchener's advice about the citizen forces. In 1913 Fisher was defeated by a very small majority at the June elections, but those of September 1914 restored him to power just after the Great War had begun, and the despatch of the first contingents (which had been offered by his predecessors) and the maintenance of the Australian effort up to October 1915 were effected under his control. In that month he resigned his post, and his seat in parliament, to become high commissioner, and held that position until 1921, when ill-health forced him to retire altogether from public life.

While prime minister the second time, he attended the Imperial conference (q.v.) of 1911—the first at which Dominion ministers were taken into the confidence of the Imperial government about matters of foreign policy—and was made a privy councillor. The knowledge of world affairs he then acquired made him more than ever a steadying influence among the less experienced and more excitable members of his party, and an important factor in securing Australian unanimity when the strain of the war was first felt.

Fisher, Sir James Hurtle (1790-1875), son of a London architect, was born in 1790 in London, articled to a firm of solicitors in 1804, and in 1811 commenced practice in Cavendish Square, London. In 1835 he was selected by the South Australian commissioners to fill the office of land-commissioner in Adelaide, which he reached with Captain Hindmarsh on 28 December 1836. Almost at once he found himself at odds with the governor over the location of the first township, the naming of places and the disposal of land. Fisher contended that these matters were entrusted to him, the governor considered himself supreme; neither would give way, and the deadlock lasted 14 months. In July 1838, however, Hindmarsh was recalled; his successor, Colonel Gawler, was appointed to the joint position of governor and resident commissioner; and Fisher, his commission withdrawn, reverted to legal practice as a private citizen. In October 1840 he was elected first mayor of Adelaide. In 1849 he advocated responsible government, and in 1853 was elected a member of the old mixed council; defeated in 1855, he became a nominated member, and was speaker of the council that legislated for responsible government. He was returned to the first council under the new constitution, and in April 1857 elected its first president, a position he held until he left public life in February 1865. For some time after this he was leader of the South Australian bar. He died at Adelaide on 28 January 1875. (Kt. Bach., 1860.)

Fisheries. See Angling and Trawling.

Fisher's Ghost. The story of this alleged ghost, described as 'well authenticated' and 'testified to by people still alive,' for over 70 years went the rounds of English and Australian periodical literature. The ascertained facts are therefore worth recording.

In 1826 two ticket-of-leave men, Frederick Fisher and George Worrall, were living together on Fisher's farm near Campbelltown in New South Wales. On the evening of 17 June Fisher left a hotel at Campbelltown in company with some friends, and not long afterwards one or two of them returned to the hotel saying that they thought Fisher had done so before them. He was not there, and was never seen again alive. Worrall, when questioned some days later, said that his friend had left the colony hurriedly in order to avoid a prosecution for forgery, leaving him authority to deal with the property; he accordingly sold some of the stock, and offered to pay a debt left by Fisher if the deeds of the farm were handed over to him. Although the affair was highly suspicious, no action was taken on it for four months, by which time the authorities seem to have satisfied themselves that Fisher had certainly not left the colony and that an investigation was due. About that time, the story goes, a man named Farley reported with every sign of terror that he had seen Fisher's ghost sitting on the sliprails of a paddock and pointing to the paddock. But of his supposed report there is no contemporary evidence; that only shows that, a reward having been offered, a constable began his investigations where blood-marks had been noticed on a fence, and with the help of two aboriginals followed certain signs to a marshy spot in Fisher's paddock where the body was found. Worrall was arrested, tried, and convicted of the murder, and before his execution admitted that he had killed Fisher, but told a provably false story of the killing.

The advertisement offering a reward for evidence of Fisher's death or departure from the colony appeared in the Sydney press at the end of September 1826. On 3 November the *Monitor* published an account of the discovery of his body 'with the help of three blacks, in a field three feet below the surface of the ground,' and within a week the authorities were advertising for 'James Smith, alias Froggy' as an accomplice in the murder. There is no hint of supernatural guidance either in the *Monitor's* story or in the fuller accounts of the tragedy which are given (in connection with Worrall's trial and conviction) in the *Sydney Gazette* of 5 February 1827 and in contemporary issues of

the *Monitor* and *Australian*. The story of the ghost was mentioned briefly in R. M. Martin's *History of the British Colonies* (vol. iv., pp. 303-4), published in London in 1835; a very full account occurs in *Tegg's Monthly Magazine* for March 1836, and from this all later versions were derived. According to W. H. Suttor (*Australian Stories Retold*, 1887) the superintendent of police at Campbelltown admitted to a friend that Farley had made the report, and that his story set the actual search going; but this is later and third-hand evidence. It is noteworthy (*a*) that no mention is made of the story at the trial; (*b*) that the ghost was not seen until, after a lapse of four months, the authorities were commencing their investigations; (*c*) that neither Farley nor any of Fisher's companions at the hotel were called to give evidence. The narrative is complete and self-sufficing without Farley. If, however, we assume that Farley did make such a report, the probabilities are that it was his way of securing himself at the same time from arrest as an accomplice and from public contempt as an informer. Suttor's discussion of the story should be studied by all serious inquirers. W.J.

Fishes of Australia. Approximately 1800 species of fishes are at present known to occur in Australian and Tasmanian waters; of these the greater number have been found on the eastern coast-line. No doubt many more await discovery in southern, western, and northern waters. The deep seas of the Australian region remain almost unexplored; but such investigations as have been carried out with dredge and trawl indicate the presence of a rich and interesting fish-fauna. From the reefs surrounding the isolated Lord Howe Island (q.v.) Waite has recorded nearly 200 species, many tropical, others from the Australian coast; the known fish-fauna of Norfolk Island is small, and closely resembles that of Lord Howe Island. The tropical coast-line, coral reefs, and numerous rivers of Papua support an exceedingly large number and variety of species, of which comparatively few have as yet been recorded; and the literature relating to them is so scattered that no estimate of their number can be made.

The marine fish fauna of Australia is composed of three elements—species derived from the north, southern forms, and deep-sea types. The tropical forms that have wandered southward along our coasts are the most numerous, and commonly extend as far down as 30° S., lat.; some have straggled even farther south. The southern types form a very distinct group, ranging over the whole coast-line south of 30° S., and extending to New Zealand. A few—e.g. the warehou (*Serio'ella*), barracouta (*Thyrsites*) and rockling (*Genypterus*)—are circumpolar, but the majority are restricted to the waters of southern Australia, Tasmania, and New Zealand. As for our deep-sea fishes, specimens taken by the *Challenger* and more recently by the federal investigation vessel *Endeavour* bear a marked resemblance to those described from the deep waters of Japan, Hawaii, and the Indian Ocean, while some are identical with species occurring in the Mediterranean, and the neighbouring Atlantic Ocean.

The freshwater fishes of Australia and Papua are almost all closely related to marine genera, and have evidently migrated from the sea since the early Eocene period, after this region had been severed from Asia by water barriers. The great sub-order Ostariophysi, which includes all the carps and catfishes so characteristic of the fresh waters of other parts of the world, is represented in Australia by a few catfishes of the marine families Plotosidae and Ariidae. Several introduced species of carp, including the gold-fish (*Carassius auratus*), have become exceedingly plentiful over a large area; they are, however, of little value as food and, as they destroy the eggs of other more valuable species, are to be regarded as pests. The only indigenous freshwater types are the archaic Burnett River salmon (*Epiceratodus*) and burramundi (*Scleropages*) of Queensland rivers, which are survivors of an ancient fauna. The Murray cod (*Oligorus*), the perch (*Percalates*) and the grunters (*Therapon*), are all members of the family Serranidae, so largely represented in all seas. Certain species of mullets (Mugilidae), silversides (Atherinidae) and gudgeons (Gobiidae) have been likewise recruited from the sea, and some are capable of living in either fresh or salt water. The jollytails (*Galaxias*) spend most of their lives in fresh water, but some species go through their larval stage in the sea.

The remarkably uniform climatic conditions of the greater portion of the Australian continent, combined with the intercalating river systems, have enabled the fishes inhabiting them to extend their range over very wide areas. As the watersheds between many of the rivers are very low, fish are able to pass from one to another in times of flood; and extraordinary aid to their distribution is afforded by whirlwinds, which occasionally sweep small fish out of a pool, transport them a short distance, and drop them in some neighbouring creek that they would otherwise have failed to reach. Such whirlwinds are common in the central areas, and have doubtless served to extend the range of both freshwater fishes and crustaceans. For an account of falls of fish during thunderstorms see Ogilby in the *Proceedings* of the Royal Society of Queensland, vol. xx. (1907), p. 29. The Spangled Grunter (*Therapon unicolor*) ranges from the western rivers of New South Wales and Queensland through central Australia to the north-western part of the continent; it has even been known to make its appearance in artesian waters soon after they have begun to flow from the bore-head, and has been erroneously supposed to have come up with the bore-water. Some specimens living in such conditions are blind, their eyes being more or less decayed, possibly from the action of gases contained in the water (Coleridge in *Report* for 1912 of the Australasian Association for the Advancement of Science, p. 354).

In common with many other aquatic animals, Australian freshwater fishes have a remarkable capacity for aestivating during long periods of drought. As a stream or pool dries up, the fish in it bury themselves in the mud, and there remain in a dried state until further rains release them. By this means areas which were previously dry are speedily stocked with fish when a flow of rain-water or artesian bore-water provides suitable conditions.

The freshwater fishes of Papua are very similar to those of Australia, and include a number of species of *Therapon* and *Atherines* of the sub-family Melanotaeniinae. As in all tropical places, a large number of marine fish penetrate the rivers far beyond reach of the tide.

Literature.—Most of the early British and French voyagers to Australia were accompanied by naturalists, who made more or less extensive collections of our fishes. Some of those taken during Cook's voyage were described in the 1780s, and a small number of species from Port Jackson and its vicinity were described and figured by Shaw in 1790, in White's *Voyage to New South Wales.* The French collector Péron sent to the Muséum d'Histoire Naturelle Australian fishes which were later described by Cuvier and his collaborator Valenciennes; many others were collected and described by Quoy and Gaimard in the 1820s. Sir John Richardson's report on the fishes taken during the voyage of the *Erebus* and *Terror* did much to advance knowledge, and many of his descriptions are even now the best published. In 1843 he published what is apparently the first catalogue of authentically Australian fishes. During the next 40 years the subject was handled by Günther, Steindachner, Castelnau, Macleay, Klunzinger, and others; Dr. Günther's *Catalogue,* published by the British museum (8 vols., 1859-1870), supplied brief descriptions of most of the species then known from Australia, and served as a basis for all subsequent workers. During the seventies Castelnau dealt principally with the fishes of Victoria, but the value of his work was greatly discounted by inaccuracy. A bibliography of Australian ichthyological literature published by Klunzinger in 1879 is all-important to Australian students; his own papers, illustrated by Konopicky, were of a high standard.

Collections from the Northern Territory were examined by Sir William Macleay, who collected extensively on the coasts of Queensland and New Guinea in the *Chevert* expedition. He also reported upon specimens collected by Masters in King George's Sound, and formed what was then the largest collection of Australian fishes; this is now preserved at the university of Sydney. His *Catalogue,* though sadly out of date, is still the only work which deals with our fishes as a whole. Largely a compilation from Günther, with scattered descriptions of other writers sorted into their places, it also included the results of much original research.

Professor McCoy described, and figured in colour, numerous Victorian fishes in his *Prodromus of the Zoology of Victoria* (2 vols., 1878-1890). J. E. Tenison Woods in 1883 was the first to combine descriptions and illustrations of the fishes of New South Wales with notes on their habits and the methods employed in their capture. Important publications dealing with edible fishes of New South Wales have been published by Ogilby and Stead. Valuable lists have been prepared by R. M. Johnston (of Tasmanian species), A. H. S. Lucas (Victorian), Ogilby & Waite (New South Wales), Zeitz (South Australian), and Woodward (Western Australian). Catalogues of the fishes of Lord Howe Island and Norfolk Island have been published by Waite. Publications of scientific societies and museums in the several States include many smaller contributions. An illustrated work entitled *Fishes of Australia* by D. G. Stead (1906) provides a general account of New South Wales species; a later work, with the same title, by T. C. Roughley (1916) includes a general account of the fishes and fishing in New South Wales, together with a number of coloured plates of local species; and the writer of this article has published (1922) a fully illustrated list of all species found in New South Wales waters.

The following list, which includes the most usual vernacular names of the principal Australian fishes, shows their inter-relationship and their place in the general ichthyological scheme.

Class Elasmobranchii, sub-class Plagiostomi:

- Order Selachii—Sharks, including Seven-gilled Shark, Port Jackson Shark or Bullhead, Tiger Shark, Hammer-headed Shark, Wobbegong or Carpet Shark, Thresher Shark, Grey and Blue Nurse, Blue Pointer, White Shark, Basking Shark, Dog-fish, Saw Shark, Angel Shark or Monkfish, Tope.
- Order Batoidei—Rays, including Sawfish, Shovel-nosed Ray, Fiddler, Electric Ray or Numbfish, Skate, Sting-ray or Stingaree, Eagle Ray, Devil-fish or Diamond-fish, Thorn-backed Ray.

Class Elasmobranchii, sub-class Holocephali:

- Order Holocephali—Elephant-fish, Ghost Shark.

Class Pisces, sub-class Teleostei:

- Order Isospondyli—Herring, Anchovy, Sprat, Pilchard, Bony Bream, Jollytail, Trout, Grayling, Smelt, Yarra Herring, Barramundi.
- Order Iniomi—Sergeant Baker.
- Order Ostariophysi—Catfish.
- Order Apodes—Eel.
- Order Solenichthyes—Pipefish, Seahorse.
- Order Synentognathi—Long Tom, Flying-fish, Garfish or Halfbeak.
- Order Anacanthini—Beardie, Red Cod.
- Order Berycomorphi—Nannygai, Roughy, Dory.
- Order Allotriognathi—Ribbon-fish.
- Order Heterosomata—Flounder, Sole.
- Order Percomorphi—
  - Families:
    - Mugilidae—Grey Mullet, Tallegalane.
    - Sphyraenidae—Sea Pike, Threadfin.
    - Stromateidae—Trevalla.
    - Serranidae—Red Perch, Orange Perch, Rock Cod, Queensland Groper, Wirrah, Banded Sea Perch, Murray Cod, Freshwater Perch, Golden Perch, Macquarie Perch, Spangled Grunter, Silver Perch, Trumpeter, Giant Perch.
    - Sillaginidae—Whiting.
    - Pomatomidae—Tailor.
    - Carangidae—Yellow-tail, Trevally, Pennant-fish, Pilot-fish, Kingfish, Samson-fish, Dart.
    - Centropomidae—Pearl Perch.
    - Arripididae—Australian Salmon.
    - Lutianidae—Sea Perch, King Snapper, Hussar.
    - Nemipteridae—Butterfly Bream.
    - Pomadasidae—Javelin-fish, Sweetlips.
    - Gerridae—Silverbelly.
    - Sciaenidae—Jewfish, Teraglin.
    - Mullidae—Red Mullet or Goatfish.
    - Lethrinidae—Island Snapper or Emperor Bream.
    - Sparidae—Snapper, Black Bream, Tarwhine.
    - Kyphosidae—Silver Drummer.
    - Girellidae—Blackfish, Bluefish, Black Drummer.
    - Monodactylidae—Silver Batfish.
    - Scorpididae—Mado, Sweep.
    - Scatophagidae—Butterfish.
    - Platacidae—Batfish.

1. White Trevally (*Caranx georgianus*).
   Dart (*Trachinotus botla*).
   Young Snapper, or Red Bream (*Pagrosomus auratus*).
2. Snapper (*P. auratus*).
   Bluefish (*Girella cyanea*).
6. Giant Boarfish (*Paristiopterus labiosus*).
7. Red Gurnard (*Chelidonichthys kumu*).
8. Sharp-beaked Gurnard (*Pterygotrigla polyommata*).
9. Dusky Flathead (*Platycephalus fuscus*).
10. Yellow Leather-jacket (*Cantherines ayraudi*).

Chaetodontidae—Coral-fish.
Enoplosidae—Old Wife.
Cheilodactylidae—Sea-carp, Jackass-fish, Morwong.
Pomacentridae—Demoiselle, White-ear.
Labridae—Wrasse or Parrot-fish, Maori, Blue Groper, Pig-fish.
Neoödacidae—Rock Whiting, Herring Cale, Rainbow-fish.
Gadopsidae—River Blackfish.
Scombridae—Mackerel, Bonito, Tunny, Albacore.
Xiphidae—Spear-fish.
Istiophoridae—Sail-fish, Sword-fish.
Trichiuridae—Hair-tail, Frost-fish.
Gempyllidae—Barracouta.
Siganidae—Black Trevally.
Gobiidae—Goby, Gudgeon, Mud-skipper.
Blenniidae—Blenny, Weed-fish.
Order Discocephali—Sucker-fish.
Order Scleroparci—Red Rock Cod, Gurnet Perch, Bullrout, Fortesque, Gurnard, Flathead.
Order Pediculati—Angler.
Order Plectognathi—Trigger-fish, Leather-jacket, Box-fish, Cow-fish, Toado, Porcupine-fish, Sun-fish.

A.R.McC.

Fison, Lorimer (1832-1907), born at Barningham in Suffolk on 9 November 1832, and educated at Sheffield and at Caius College, Cambridge, in 1856 migrated to the Victorian goldfields, and in 1861 entered the university of Melbourne. While there he joined the Wesleyan ministry, was ordained in 1863, and was at once sent to do mission work in Fiji. Returning to Australia in 1871, he happened to meet A. W. Howitt, who had for some years past interested himself in anthropological studies among the Australian natives; the two at once entered on a remarkable personal friendship and scientific collaboration, which resulted in the publication at Melbourne in 1880 of *Kamilaroi and Kurnai,* which Sir J. G. Frazer described as 'a document of primary importance in the archives of anthropology.' Long before this, however, Fison had returned to Fiji—Britain had annexed the group in 1874, and his knowledge of the natives was much needed by the new government. He was an invaluable friend to Sir W. MacGregor and Sir J. B. Thurston, as well as to officials, merchants, and planters. His *Land Tenure in Fiji* (1881), first published in the *Journal* of the Anthropological Institute, was reprinted in a British Blue Book, republished in 1903 by the Fiji government press, and translated into German.

In 1884 Fison left Fiji for Victoria, residing first at Hawthorn, then at Flemington, finally at Essendon (all suburbs of Melbourne). From 1888 to 1905 he edited the *Spectator,* a local Wesleyan periodical; he also helped to found Queen's College within the university of Melbourne, and was one of its first fellows. In 1892 he was president of the anthropological section at the Hobart meeting of the Australasian Association for the Advancement of Science, and on the invitation of the British Association visited England in 1894 to represent Australia at the association's meeting at Oxford, where he was associated with Professor Tylor and Max Müller. In 1904 he published *Tales from Old Fiji.* In 1905 A. J. Balfour, then British prime minister, allotted him a civil list pension of £150 for his distinguished services to anthropology. He died at Essendon on 29 December 1907.

Fitzgerald, Charles (1798-1887), born in 1798, entered the royal navy in 1809, served in a naval campaign against Algiers, was made commander in 1840 and retired in 1856 with the rank of captain. From 1844 to 1847 he was governor of Gambia in West Africa, and was thence transferred to Western Australia, entering office there on 12 August 1848. His term of office included several notable events in the colony's history. In 1848 the first systematic census was taken; on 1 June 1850 the first convicts arrived (reformatory boys had been coming since 1843); the next year (on 13 March 1851) the colony was offered a representative legislative council, but did not take advantage of the offer (see Constitutions); in 1853 a chamber of commerce was founded, and in 1854 the first postage stamps were issued. Almost at the outset of his governorship Fitzgerald nearly lost his life, being speared in the leg by hostile blacks while returning from a visit to mineral lands just discovered by A. C. Gregory (q.v.) in the basin of the Murchison. He resigned his position in July 1855, and returned to England, where he died on 29 December 1887. (C.B., 1857.)

Fitzgerald, John Foster Vesey—known in Australia by his earlier name John Fitzgerald Leslie Foster—son of the Irish judge John Leslie Foster, was born in Dublin on 19 August 1818 and educated at Trinity College, Dublin (B.A., 1839). In 1841 he migrated to Port Phillip to take up pastoral pursuits, and from 1846 to 1848 represented the district in the New South Wales council. In July 1848 he was nominated for Melbourne, but was rejected in favour of Earl Grey (see Victoria); he was, however, in 1849 re-elected for the district of Port Phillip, but held the seat for one year only. After a visit to England he returned to the colony as colonial secretary, succeeding Lonsdale; in this capacity he administered the government in the interval between Latrobe and Hotham, passed the act that gave Victoria responsible government, turned the first sod of the Williamstown railway, introduced the telegraphic system, and took an important part in the conflict between miners and government that culminated in the Eureka Stockade. Although he was by no means responsible for many of the actions that embittered the miners' feeling, he was selected as scapegoat when they forced the governor's hand, and in December 1854 resigned in order to restore public confidence in the administration—a patriotic act which was its own reward. In 1856 Williamstown returned him to the new assembly, but among the newcomers he was out of his element; for seven weeks he was treasurer in the O'Shanassy ministry of 1857, and then retired to England, where he lived the rest of his life. From 1860 onwards, his mother having altered her name and that of her issue in accordance with the will of her brother the last Lord Fitzgerald, he was known by the name under which he appears here. He was still alive in 1892, but his death seems to have occurred soon afterwards.

FitzRoy, Sir Charles Augustus (1796-1858), grandson of that duke of Grafton who helped to lose Britain her American colonies,

was born on 10 May 1796 and educated for a military career; he obtained a commission in the horse guards, and was present as a staff officer at Waterloo. Leaving the army in 1830, he entered politics in 1831, but after one session left parliament also, and in 1837 was made lieutenant-governor of Prince Edward Island, and transferred in 1841 as governor to the Leeward Islands, where he built up a reputation for conciliating the colonists. Consequently, when the colonial office found that the politicians of New South Wales were growing restive under the able but stern rule of Gipps, FitzRoy was at once thought of as the obviously suitable successor, and in August 1846 reached Sydney and took up the reins of government—which he proceeded to hold very slackly. The personal popularity that naturally resulted from this was increased by popular sympathy with the governor on account of a distressing accident—the bolting of his carriage horses down the drive from the old government house at Parramatta, on 7 December 1847—which killed his wife and made him a cripple for many months. Retiring from his post on 17 January 1855, he settled down in London and died there on 16 February 1858.

FitzRoy himself was by no means a strong character, but in his term of office a strong governor would have done great harm. To students, looking back on those days in the light of what has happened since, it is clear that a good deal of excellent advice was given by the Imperial authorities, and Australia would have benefited if that advice had been followed; yet any attempt—such as Gipps would certainly have made—to insist on obedience to British authority would have driven the politicians and people of New South Wales to extreme measures, possibly to a declaration of independence. FitzRoy's part in moulding Australian society into fitness for responsible government is well defined by Rusden (*History of Australia* ii. 433):—

> With Wentworth controlling the bulk of the elected members—and desiring to form as close a copy of English institutions as circumstances permitted—with Deas Thomson suave and astute, loyal to the Queen and to the Governor, and patriotic as a colonist—with Sir Charles Fitzroy ready to assume responsibility when necessary, but content to leave the man who bore the brunt of battle to conduct the campaign in his own manner so long as principles decided on in the executive council were kept in view—the public men of New South Wales were gradually inured to parliamentary methods.

Nor was the exercise of his tact and conciliatory powers confined to Australia. His handling of the somewhat doctrinaire Earl Grey, while the latter was secretary of state for the colonies in 1846-52, was mainly responsible for the drastic modification of that politician's schemes, which in their original state would have produced endless friction and possibly worse. Here too it is probable that the guiding hand was that of Deas Thomson; but the governor deserves credit for knowing when to follow a good guide, and for supporting him steadily throughout. FitzRoy's term was crowded with events and problems. The anti-transportation agitation, the demand for the separation of Victoria, the claim for and devising of a new constitution in all the Australian colonies, the discovery of gold and the consequent disruption of the older (squatters') social regime, all fell within his period and had to be handled under his supervision. To deal with the constitutional questions, and to secure as much uniformity as possible without coercing the various colonies concerned—probably also to provide machinery for a scheme of Australian federation which Earl Grey much desiderated and local politicians much disliked—FitzRoy was on 3 January 1851 made governor-general of all the Australian colonies; this position, it was explained, was not intended to give him powers of general interference with their administration, but would provide him with a 'general authority to superintend the initiation and foster the completion of measures calculated to promote the common welfare.' It was, indeed, probably suggested by a despatch of his own (of 29 September 1846) advocating the appointment of 'some superior functionary . . . . to whom all measures adopted by the local legislatures affecting the general interests of the mother country, the Australian colonies, or their intercolonial trade, should be submitted by the officers administering the several governments before their own assent is given to them.' (Kt. Bach., 1837; K.C.B., 1854.)

Five-corners, a name given to the fruit of several species of *Styphelia* (q.v.). They are succulent drupes, with a sweetish pulp and a relatively large 5-angled stone containing five seeds; small boys appreciate them, and the aborigines in many districts use them for food. The best-known of the species are *S. viridis* and *S. triflora*.

Flagellariaceae, a small family of plants of which the only indigenous representative is *Flagellaria indica*, also widely distributed over tropical regions of Asia and Africa. It is a tall climber. The branches at the base are enclosed by the leaf-sheaths; leaves ending in a spirally twisted point which acts as a climbing tendril; flowers white, in clusters; fruit a small, nearly globular, drupe. Leichhardt, in his *Overland Journey to Port Essington*, says that his bullocks fed heartily on this plant, particularly as the country was most wretched and the grass scanty and hard. The stems are made into walking-sticks. The leaves are said to be astringent.

Flame-tree, the popular name for *Brachychiton acerifolius*, a large tree usually found in coastal brush forests, and confined to New South Wales and Queensland. The deeply lobed leaves are shiny, and fall before the tree flowers. It produces masses of bloom of a vivid scarlet; as the stalks of the bell-shaped flowers are also coloured, the result is a flame-like display which suggests the popular name. The flowering period is very irregular; in some instances the trees bloom for several consecutive years, but an individual tree may not produce flowers for several years. It is also known as the 'lace-bark tree.' When the tree is full-grown, the bark is fully 2 inches thick, and furnishes bast of a beautiful lace-like texture. The fibre is prepared by simple steeping, and is suitable for cordage, nets, mats, and baskets. It is also a good material for paper-making. The tow is of an elastic nature, suitable for upholstery, e.g. stuffing mattresses.

Flannel-flower, the popular name of *Actinotus helianthi*, a stout erect perennial herb of 1-2 feet, covered with a dense clothing of woolly hairs. The flowers are numerous, small, on short slender stalks, collected in a dense umbel and radiating from the top of the common flower-stalk, forming a convex button-like

head, resembling a daisy; calyx deeply divided

Flannel-flower.

into narrow, hairy, transparent lobes; petals obsolete; fruit flattened, covered with silky hairs; leaves twice tripartite, the usually obtuse segments again lobed. The spreading, woolly-white flannel-like bracts surrounding the umbel —often mistaken for petals—accentuate the likeness, and the flattened, hairy fruits contribute to the illusion. Its botanical name was given it by the early French botanist Labillardière. It extends from Gippsland in Victoria to southern Queensland, and is particularly abundant in the coastal districts of New South Wales. The plant is difficult to propagate; many of the seeds are infertile, and a few which germinate do not respond to cultivation. Seedlings taken from the bush rarely thrive. The plants are subject to a deformity known as 'fasciation,' which produces a banded or ribbon-like growth of the stem. They also occasionally break into a prolific floral growth, as in the 'Hen and Chickens' daisy.

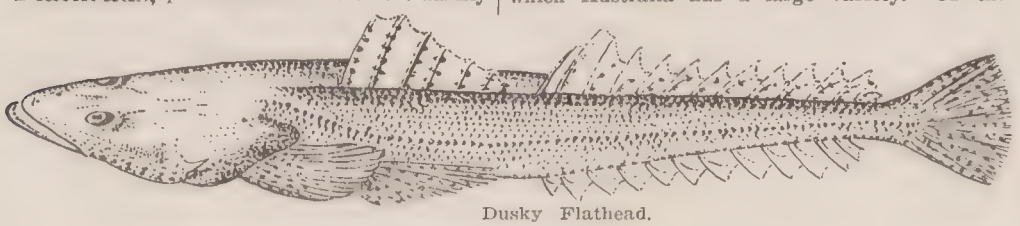
Flatheads, prized table-fishes of the family Platycephalidae, represented by over 30 species in Australian waters. They derive their name from the greatly depressed and expanded head, which is always considerably wider than the body, and is armed with spines capable of inflicting painful wounds. Being 'bottom' fish, they bury themselves in mud or sand, leaving only the upturned eyes exposed as they lie in wait for their prey. Their colour harmonizes with their environment, and the lower jaw projects forward in advance of the upper, so that the capacious mouth is directed upward and in the best position to snap up a crab or small fish unfortunate enough to approach.

Flatheads range from the shallows down to the depths, and are taken by line, hauling-nets, and trawlers. Those occurring in our cooler waters belong to the typical genus *Platycephalus*, but most of the tropical species are members of an allied genus (*Insidiator*) which is distinguished by the form of the teeth. In some the scales are minute, while in others they are large and rough. Their colours vary from the muddy-brown of the Dusky Flathead (*P. fuscus*) to an assemblage of beautiful lilac and mauve tints wonderfully variegated as in the Rock Flathead (*Thysanophrys cirronasus*) which harmonize with the weed-covered rocks among which the species lives. The Tiger Flathead (*Platycephalus macrodon*) is captured in large quantities by trawlers in deep waters, and is covered with small scarlet spots on a greenish ground-colour. Each State has its common local species, and all find a ready sale in the markets.

The spiny flatheads (family Hoplichthyidae) are distinguished by a row of stout bucklers with central spines along each side of the body. The head is greatly flattened and expanded, and the eyes are of large size to enable the fish to see in the dark depths they inhabit. *Hoplichthys haswelli* is plentiful in water of a depth of about 150 fathoms, where it is taken by trawlers; notwithstanding its forbidding appearance, it is a good food-fish. A.R.McC.

Flat-worms, the vernacular name of 'worms' (so-called) of the phylum Platyhelminthes, which includes the liver-flukes, tapeworms, and their allies. They are characterized by the formation of their alimentary canal—which opens anteriorly by a mouth, but ends blindly within the body—and by the absence of a body-cavity, the whole interior being packed with parenchymatous tissue. The phylum is divided into three classes—Turbellaria, Trematoda, and Cestoda; the last two are discussed under LIVER-FLUKES and TAPEWORMS.

Turbellaria are usually flattened and leaf-like in form, and move chiefly by means of minute protoplasmic processes (cilia) on their outer surface, which are capable of lashing forwards or backwards. From an Australian point of view the most interesting group of Turbellaria is that of the land planarians (q.v.), of which Australia has a large variety. Of the



Dusky Flathead.

marine forms *Diplosolenia*, a chocolate form with red and white margins, attains a length of two inches and a width of 1½ inches; *Leptoplana* is known to oyster-growers as 'the wafer,' and is accused of attacking oysters. In rivers and lakes forms belonging to the genera *Dendrocoelum* and *Mesostoma* are of common occurrence. A number of marine and several freshwater Turbellaria have been described by Haswell (see papers in the *Quarterly Journal of Microscopic Science* and in the *Journal* of the Linnean Society of London). L.H.

Flax. *Historical.*—Governor Phillip's instructions included a direction to attend to the cultivation of 'the flax-plant which is found in the islands not far distant from the intended settlement'—obviously the New Zealand flax (*Phormium tenax*) which Banks in 1770 and Matra in 1783 had noticed and praised highly. Phillip, however, mistook for the *Phormium* a much slenderer, reed-like plant (*Gymnostachys anceps*) which the Port Jackson natives used for making fishing-lines. This he found difficult to cultivate, as the natives pulled up the plants before they seeded. Some English flax-seed was also brought out, but seems to have failed. Hunter in 1798 applied for a fresh supply of seed; King took great trouble with the consignmeat that followed, and also experimented with a native flax-plant (*Linum marginale*, a relative of the European species) which was found growing in profusion on the banks of the Hawkesbury. In 1801 nearly 650 yards of linen was manufactured from the English plants. By 1804 nine looms were at work, and the output was 100 yards weekly; linen, sacking, and sailcloth were all manufactured. Marsden (q.v.) devoted a large area of his Hawkesbury lands to the cultivation of flax and hemp. Gradually, however, as methods of preparing and spinning the product of the New Zealand flax-plant were discovered and improved, the European plant fell out of favour. In 1810 Macquarie offered bounties for its local cultivation, but the demand was too limited to induce cultivation even with the aid of the bounty. Moreover, as the wool industry developed and prospered, woollen goods largely superseded linen. In 1824 a certain T. A. Curtis put before Lord Bathurst elaborate proposals for re-establishing the flax industry, and 369 barrels of seed were sent out for experiment; but the seed arrived in poor condition ('only one grain out of 150 retains its germinating principle') and at the wrong time of year, and—as Brisbane pointed out—it was lack of demand, not improper methods of cultivation, that had destroyed the industry already.

In Tasmania the first settlers found growing along the Derwent 'a great abundance of Grass . . . . which produces a Sort of Flax'—probably *Gymnostachys*; but nothing was done with it, and when many years later (in 1826) Arthur asked for a supply of flax-seed, Bathurst quoted the result of the Curtis shipment, and refused to try again.

Commercial.—In recent years (since about 1898) flax has been intermittently cultivated in Gippsland, and attempts have been made to introduce it to New South Wales and Tasmanian farms. From 1907 to 1917 the Commonwealth offered a bounty of ten per cent of the market value on all products of Australian-grown flax, but without apparent effect. During the war, however, the supply of flax from the Baltic provinces of Russia—which practically met the world's demand—almost disappeared, partly because Germany occupied the flax-growing districts, partly because the Bolshevik authorities seized all the seed for food purposes; the army council in England, therefore, agreed to purchase the 1918 Australian flax-crop at £170 per ton of fibre, and the Commonwealth authorities thereupon offered a bounty of £5 per ton (1918, 1922) and £6 (1919-21), and appointed a flax-industry committee to administer an act which provided *inter alia* for financing the establishment of mills to treat the flax-hay wherever grown in sufficient quantities to warrant it. This act expired in 1921, but was extended to cover operations in 1922. The results are shown in the following table:—

	Acres under cultivation.	Seed produced.	Fibre produced.
1917-18	419	1337 cwt.	925 cwt.
1918-19	1420	5200 „	3800 „
1919-20	1611	4970 „	1053 „
1920-21	993	3658 „	938 „
1921-22	918	4687 „	440 „
1922-23	590	3450 „	435 „

Up to the middle of 1922 the whole of the commercial flax crop was grown in Victoria (mostly near Geelong), but in the 1922-23 season 125 acres were planted in New South Wales, in the Albury and Twofold Bay districts. Flax sent to England in 1920 realized £325 per ton.

Flax cultivation in Australia is adapted to local conditions, the crop being harvested with a reaper and binder at a comparatively late stage of development, and the seed maturing while the sheaves are still in the field. The method of treatment is known as 'dew' retting: the straw is spread in thin layers over the paddock and thus exposed to the action of sun and dew.

Fleas, insects of the order Aphaniptera (or Siphonaptera), numbering a few species only, but cosmopolitan in habitat and all parasitic upon either mammals or birds. They are characterized by the highly-specialized piercing mouth-parts, the shape of the body (laterally, not vertically, flattened), and their great leaping powers, as well as by the absence of wings through degradation. The Aphaniptera are related to the Diptera, of which order some entomologists consider them only a sub-order; but it seems best to consider them a separate order that arose, probably, either from the very base of the Diptera or from the older order Mecoptera.

The flea's life-history is interesting. The eggs are laid either on or off the host; the larva is an elongated, legless grub, much resembling that of one of the mycetophilid Diptera. Larvae of fleas infesting the cat and dog are capable of nourishing themselves on the refuse and dust accumulated in an unswept room, and rapidly reach maturity. The pupa is enclosed in a light silken cocoon, and is of the *pupa libera* type.

About 30 species of flea are known in Australia. The fleas common in houses are either the world-wide *Pulex irritans*, or *Ctenocephalus canis* and *C. felis* (the dog- and cat-fleas), or *Ctenopsylla musculi* (the mouse-flea); all these take equal pleasure, apparently, in biting man and their normal hosts. The rat-flea (*Ceratophyllus fasciatus*) is abundant, as also the tropical rat-flea (*Xenopsylla cheopis*), the latter being the species instrumental in the spread of bubonic plague.

Of the species peculiar to Australia a number belong to the genus *Stephanocircus*, and are parasitic on various marsupials. The most interesting form is the peculiar *Echidnophaga ambulans*, whose host is the echidna. *Parapsylla australica* occurs on the little blue penguin. The largest flea yet found in Australia is *Pygiopsy la rainbowi*, found on the water-rat.

N. Rotschild added considerably to the number of species known in Australia. R.J.T.

Flies. The classification and natural history of these insects will be found under DIPTERA; here their economic importance as malignant or beneficent agents is discussed. As in other orders of insects, comparatively few of the indigenous Diptera are serious pests, most of the troublesome ones having been introduced.

Fruit-flies.—The most serious fruit-pests in Australia are the Mediterranean Fruit-fly (*Ceratitis capitata*) and the Queensland Fruit-fly (*Chaetodacus tryoni*). The former appeared in Western Australia in 1896; by 1899 the Swan River district was so badly affected that it was difficult to obtain a single sound peach or orange, and most of the softer apples and pears were attacked. It is now also a serious pest in eastern Australia; in Victoria and Tasmania, owing to the vigilant action of the official entomologists, it was quickly exterminated; it has not as yet appeared in South Australian orchards, but an unceasing watch is kept for it, and every year maggot-infected fruit is destroyed at ports of entry in the three States mentioned. The mature flies puncture ripening fruits, and in the small hole made lay a batch of about ten eggs. Sometimes many flies oviposit in the same fruit, so that the inside soon becomes a mass of squirming maggots. No effective and cheap controls are known. Kerosene has a powerful attraction for the males, but little for the females, and is therefore not of much use. Fly-papers, sprays, and poisons are also employed. In some Mediterranean districts the more valuable oranges are protected by enclosing each in a paper bag; in Western Australia and parts of Africa whole trees are enclosed in mosquito-netting or hessian. Gathering and destroying fallen fruit, and (where possible) picking unsound fruit, help to minimize the trouble. In Western Australia efforts to cope with the pest by the introduction of parasites (notably from Brazil) ended in complete failure. Many local insects attack the maggots after they have left the fruits—ants and carabid beetles being often in evidence—but no parasite of any importance has yet been found. There are several broods in a season, and in some districts it is difficult to obtain sound fruit of the later sorts. The fly attacks a wide range of fruits, even including the prickly pear and native berries.

The Queensland Fruit-fly (*Chaetodacus tryoni*) is very troublesome in northern Australia, India, and elsewhere. Sydney appears to be its most southerly range, but in this region it may disappear for years. This fly works its mischief very much as does the Mediterranean fly, but attacks a greater variety of fruits. In Queensland it infests many solanaceous berries and wild fruits, particularly guavas (which are victims of two other species as well); it is for this reason, probably, that the pest is so widely distributed in that State. Bananas especially are damaged, and have to be prematurely picked to avoid infection. In berries and the smaller wild fruits the maggots are often destroyed by small ichneumon parasites; but in the larger fruits the maggots live so far below the skin that parasites have very little chance against them. A vigorous outlook is being kept to prevent its introduction into hitherto uninfested States; fortunately it appears able to live only in warm climates.

Other fruit-flies are known, but are of less consequence.

The Tomato-fly.—The tomato in many parts of Australia is more or less seriously attacked by the 'blue' tomato-flies (*Lonchaea aurea* and *L. rugosifrons*) small, brilliantly metallic species about half the size of the Mediterranean fruit-fly. The maggot is about the same length, but much thinner; it is often mistaken for the other. The fruits are usually attacked long before they are ripe.

Ferment-flies.—Decaying fruits and other fermenting vegetable matter—grape must, vinegar, sour beer, etc.—are often seen to be swarming with small, yellow, red-eyed flies. These are ferment-flies, of which *Drosophila ampelophila* is the commonest species. The maggots are sometimes so abundant that alarm has been caused by confusing them with fruit-fly larvae. They do not, however, attack sound fruit.

Leaf-miners.—The introduced Marguerite or Cineraria Fly (*Phytomyza nigricornis*) is now almost universally distributed in Australia, and the white tunnels of its larvae may be seen in leaves of many kinds of plants, especially among the Compositae. A smaller native species (*Phytomyza betae*) attacks the beet, and will probably in time become a serious pest of the sugar-beet. In Western Australia its larvae are sometimes seen drilling the leaves of several poisonous plants.

Bean-fly.—A minute black fly (*Agromyza phascoli*) attacks the stems of beans in Queensland and New South Wales, and often kills the young plants; but its larvae and pupae are destroyed by a great variety of small parasitic Hymenoptera.

Useful Flies.—Aphides are commonly attacked by syrphid larvae; the curious thick-ended (and usually pale-green) blind maggots may be seen amidst clusters of aphides, and one will impale an aphis, hold it in the air till it is sucked dry, and then with a tremulous motion wave its head-end about till it can impale another specimen. This process may be continued for days. Unfortunately the larvae are themselves severely parasitized by small ichneumon and chalcid wasps. One of the commonest of the useful species is *Syrphus viridiceps*, which occurs in all the Australian States. Several curious forms live in the nests of *Iridomyrmex* ants (q.v.).

Many tachinid flies are parasitic on larvae of moths and butterflies; others attack locusts. *Locustivora pachytili* (which is now usually referred to the Sarcophagidae) is very useful in this respect. Very small flies of the Phoridae are parasitic on beetles in the adult stage, and others destroy their larvae; some species also infest cockroaches and other troublesome insects.

House-fly.—The house-fly (*Musca domestica*), of almost universal distribution, is the best-known instance of an insect that was formerly considered unimportant though annoying, but is now known to be one of man's most serious enemies, and largely responsible for the distribution of typhoid, tuberculosis, infantile diarrhoea, sandy blight, and ophthalmia—even,

occasionally, for the transmission of yaws and anthrax. These flies breed very largely in stable manure; and, as the female lays an average of 120 eggs, and in summer a generation may be produced every ten days, they soon become superabundant. Hence in cities it is now a common recommendation that manure be thrown into air-tight receptacles till it can be removed, or covered with lime or other fly-deterrents. Much of the mortality in past wars, and amongst permanent armies in India, is believed to have been due to these formerly despised creatures. They cannot pierce flesh, but their tongue has a slight rasping arrangement by means of which they can extract moisture; and, being especially attracted by cuts and sores, they easily infect their victims. In the drier parts of Australia this fly and the allied 'cattle' or 'bush' fly (*Musca vetustissima*) are incessant and irritating pests.

In 1912 Harvey Johnston discovered in these two flies, and in the Stable-fly (*Stomoxys calcitrans*), minute nematode worms which in the previous year had been shown by H. B. Ransom to be the larval stages of a species of *Habronema*, a parasite found in the stomach of the horse. In 1916-8 the work of Bull in Adelaide and of Lewis and Seddon in Victoria proved that this parasite caused granulomatous sores and inflamed eyes in horses, and possibly also the 'swamp cancer' known in the Northern Territory. G. F. Hill in 1918, and Harvey Johnston and M. J. Bancroft in 1918-20, published careful investigations into the life history of *Habronema* which confirmed the earlier results, and showed that each fly was host to a particular species of the parasite; those harboured by *M. domestica* usually infect stabled animals, but *M. vetustissima* is responsible for the transmission of equine granuloma to stock out of doors. The subject is fully treated in the *Proceedings* of the Royal Society of Queensland for 1919 and 1920 and the *Memoirs* of the Queensland museum for 1920. See BLOOD-SUCKING FLIES and BLOWFLIES. **A.M.L.**

Flinders, MATTHEW (1774-1814), son and grandson of surgeons, was born at Donington in Lincolnshire on 16 March 1774, educated first at the Donington free school and later at the Horbling grammar school, and designed by his father to follow the family profession. But the boy read *Robinson Crusoe*, and the course of his life was altered. Against the wish of family and friends he determined on a naval career. His father's consent was reluctant, and the advice of his uncle John Flinders, who had served 11 years in the navy and was not yet a lieutenant, was naturally discouraging. Matthew, however, was undeterred, and applied himself to the study of mathematics and navigation; through a cousin who was governess to the daughters of Captain Pasley he obtained an introduction to that officer, who entered him in H.M.S. *Alert* as lieutenant's servant on 23 October 1789 and seven months later (on 17 May 1790) took him under his own charge in the *Scipio* and—as midshipman—in the *Bellerophon*.

He saw no real service until the following year, when he entered upon a voyage which determined his future work. William Bligh (q.v.) was fitting out a second expedition—that of the ill-fated *Bounty* having been the first—to convey bread-fruit trees from the southern Pacific to the West Indies. An opportunity presenting itself of joining H.M.S. *Providence*, the ship selected for the purpose, Flinders with Captain Pasley's consent took it. The expedition was successful, and its educational value for the young midshipman was great. Bligh, a fine sailor, found Flinders's theoretical knowledge of navigation very useful, and employed him in the preparation of charts, the making of scientific observations, and the care of the chronometers and other instruments. From this voyage dates the definite hankering after exploration, the successful prosecution of which constitutes Flinders's principal claim to remembrance. When the *Providence* returned in 1793, Flinders again served under Pasley in the *Bellerophon*, and took part in the great action off Brest on 1 June 1794, when Howe inflicted a severe defeat on the French navy. The fifth lieutenant of the *Bellerophon* was Henry Waterhouse; he at the conclusion of the campaign was promoted to the command of H.M.S. *Reliance*, then being got ready to convey the second governor, John Hunter, to New South Wales. Flinders, eager for experience, and hoping to find in Australia scope for the kind of work he was most anxious to do, joined the *Reliance*, and sailed in her in February 1795. The ship's surgeon was another young man from Lincolnshire, George Bass (q.v.).

The exploratory work of Flinders—commencing with a cruise in the *Tom Thumb* in company with Bass, including the demonstration that Australia and Tasmania were separated by a strait, and concluding with the circumnavigation of the continent in the *Investigator*—is treated elsewhere (see EXPLORATION BY SEA). Here only biographical facts need be noted. Flinders secured his lieutenancy in 1797 returned to England in the *Reliance* in 1800, and was promoted commander in 1801. The admiralty was just then, under the influence of Sir Joseph Banks, fitting out a ship for exploration of the southern shores of New Holland. The *Xenophon* was chosen and renamed *Investigator*, and Flinders's previous services (and the friendship of Banks) secured him the command. He sailed in July 1801, resolved, as he wrote to Banks, 'that no person shall have occasion to come after me to make further discoveries;' and few men in maritime history have combined eminently unsparing devotion to an arduous task with such great practical skill and scientific knowledge.

On 7 December he reached the Leeuwin and commenced his detailed survey of the southern coast; on 8 April 1802 he met Nicholas Baudin, captain of a French exploring ship, *Le Géographe*, in Encounter Bay; on 9 May he reached Port Jackson, but started north on 22 July, examined the coast up to the Percy Isles and from Cape York to Arnhem Bay in the Northern Territory, and was then (March 1803) forced by the condition of his ship to run for Timor, make what repairs he could, and return hastily to Sydney round the western coast of Australia, reaching Sydney again after a perilous voyage on 9 June. From this time onwards he plunged into a series of misfortunes that made the later phases of his career little less than tragic. Wishing to take to England without delay the charts he had compiled, and finding the *Investigator* quite unseaworthy, he accepted a passage in the *Porpoise* and sailed on 10 August, intending to make for Batavia by the Torres Straits route. A week out from Sydney the vessel was wrecked on a reef in

the open ocean about 230 miles north-east of Sandy Cape in Queensland. Flinders organized a miniature colony on the reef, fitted up the *Porpoise's* cutter, and made his way back to Sydney; but Governor King, though keenly sympathetic with one whom he much admired, could give him no better a vessel than the *Cumberland*, a locally-built 29-ton craft, in which to make the best of his way home to England. To a seaman of Flinders's skill and courage the difficulty did not seem insuperable. He sailed on 21 September, again taking the passage through Torres Straits, reached Timor in October, and thence made sail to cross the Indian Ocean. The leaky condition of the ship gave constant trouble, and the pumps, worn by constant use, became unserviceable; Flinders therefore felt compelled to make for Ile de France (Mauritius), in order to get the schooner caulked and the pumps refitted before attempting the passage round the Cape of Good Hope. Ile de France was then a French colony, administered by General Charles Decaen, an officer who had won his rank during the wars of the Revolution, and whose soldierly qualities had attracted the quick eye of Napoleon. Flinders at the time of his arrival was not aware that war between England and France had again broken out. Had he known this, however, it is probable that he would still have sought assistance; for he bore a passport from the French government, and the usage of nations was understood to protect from hostile treatment vessels engaged on scientific service. But the misfortune which had pursued him since the abandonment of the *Investigator* reached its climax in Ile de France. As he was making for port, on 15 December, a French schooner ran before him, and reported on her arrival that she had been chased by an English ship; consequently a certain element of suspicion attached to him from the outset. At Baie du Cap, the port of arrival, the military force had been called out, and after a little delay a French officer came off to the *Cumberland* and demanded Flinders's passport. It was then seen that the document was made out, not for the *Cumberland*, but for the *Investigator*—a circumstance which, in the officer's eye, made it necessary that Flinders should give an explanation to the governor. At the first examination Decaen, apparently suspecting that Flinders was a spy, questioned him with a view of discovering from his answers whether his pretensions were *bona fide*. Consequently, when after the examination he sent an officer to invite Flinders to dinner, the latter, resenting the treatment to which he had been subjected—and not making sufficient allowance for the anxieties of a general charged with the duty of defending a colony thousands of miles from sources of supply and reinforcement, and in daily dread of attack from a British fleet—refused the invitation. Decaen in his turn resented this behaviour. A contemporary manuscript history of Ile de France (now in the Bibliothèque Nationale at Paris) describes Flinders as showing 'much impertinence' and 'arrogance,' whereas Decaen, according to the same writer, 'received him in uniform bareheaded,' and was disposed to listen patiently to his explanation. From this time onwards, at any rate, Decaen's disposition was harsh, and he resolved not to deal with the case himself, but to send a statement of the facts to Paris in order that the will of the government might be pronounced, in the meantime detaining Flinders as a prisoner. In 1806 Napoleon ordered Decaen to set him at liberty, but the general took the responsibility of not acting upon the instruction, explaining that he deemed the prisoner too 'dangerous' to be allowed to go. The evidence shows that he believed Flinders, during the years of his detention, had acquired too much information about the defences of the island to make it prudent to let him go. The malevolence which has been attributed to Decaen was not a characteristic of his. Flinders himself, who certainly had no particular reason for thinking kindly of him, testified that he bore 'the character of having a good heart, though too hasty and violent.'

The statement has been frequently made that during Flinders's detention his papers and charts were seized by the French, and dishonestly used in the preparation of the atlas illustrating the history of Baudin's expedition. For this charge there is not a tittle of evidence. Flinders made no such accusation; and a careful examination of the French charts affords not the slightest warrant for assuming that those who prepared them ever saw any of Flinders's material. It is true that his papers were taken from him, and sealed up; some were restored to him, at his own request, during his imprisonment, in order that he might occupy his time with the preparation of his charts; Decaen kept one log-book, because it contained entries showing why Flinders called at Ile de France; and the remaining papers he received back on his release, intact (according to his own testimony) except a few that had been eaten by rats.

On 13 June 1810 Flinders was released, and reached England on 23 October. For the remainder of his life he was chiefly occupied with the writing of his book—*A Voyage to Terra Australis*—and with the preparation of his charts. In a modest footnote in his book he suggested the name 'Australia' for the continent (see AUSTRALIA, NAMING OF). He died on 19 July 1814, at the age of 40, leaving a widow and one daughter in somewhat straitened circumstances: the first copy of his book had been delivered at his house on the previous day, but he was too ill to see it.

It cannot be said that he was liberally treated by the admiralty. Had he returned to England in 1804, he would have been promoted to the rank of post-captain. His detention in Ile de France cost him not only loss of health and great distress of mind, but also six years' extra pay; and the exigences of his work upon the charts and the book involved four years' personal expenditure of £200 a year in excess of his income. In 1852 the governments of New South Wales and Victoria granted to his daughter, Mrs. Petrie, a pension of £200 a year, and continued to pay it for 40 years—an honourable recognition of Australia's debt to one of the foremost, bravest, and ablest of her maritime explorers. E.S.

In 1901 Professor (now Sir) W. M. Flinders Petrie, grandson of the navigator, presented to the public library of Victoria transcripts from early journals (e.g. that of the boat-voyage of 1796) and a letter-book covering the period 1807-14. About 20 years later Sir Flinders Petrie agreed to present the rest of the Flinders papers in his possession to whichever of the Australian States would erect a suitable memorial to the explorer. New South Wales promptly offered to put up a statue, and the papers—which include two volumes of the *Investigator's* log

(1801-3), three letter-books, and Flinders's private diary from 17 December 1803 to 10 July 1814—were handed over to the State government and purchased by the trustees of the Mitchell Library, the purchase money defraying the cost of the bronze statue of Flinders by the late W. R. Colton, R.A. The sculptor died after executing the model but before the statue was cast.

See Flinders's own *Voyage to Terra Australis* (2 vols., London, 1814) and Scott's *Life of Captain Matthew Flinders* (Sydney, 1914). In the *Naval Chronicle* for 1814—vol. xxxii—there is a biographical sketch of the navigator based largely on material supplied by himself; and a valuable collection of his letters is reprinted in vols. iii-vii of the *Historical Records of New South Wales*. The *Voyage de Découvertes aux Terres Australes*, by Péron and Freycinet (Paris, 1807-17), gives the official account of the relations between Flinders and Baudin; the latter's diary is in the Bibliothèque Nationale at Paris, and many unpublished despatches in the Archives Nationales. Prentout's *L'Ile de France sous Decaen* (Paris, 1901) gives an account of Flinders's captivity in the Mauritius founded on the Decaen papers; these are preserved at Caen, and the documents relating to Flinders are as yet unpublished.

Flindersia, a genus of the family Rutaceae, endemic in Australia, consisting of trees with small flowers and large, elongated, capsular fruits covered with rough tubercles. The seeds are flat and winged. There are 16 species, all eastern. *F. australis* (Native Teak) is a coastal brush tree 100-120 feet high, ranging from northern New South Wales to Queensland. The fruit, owing to conical tubercles on the shell, is known as rasp-pod. The timber is hard and of great strength and durability, not discoloured by iron, and shrinks but little in drying; hence it is excellent for railway purposes. *F. Oxleyana* (Yellow-wood) is also a coastal brush tree in New South Wales and Queensland. It reaches a height of 100 feet, with a diameter of 3-8 feet. The timber is largely used in the frame-

Leopard Tree.

work of railway carriages and waggons, and is said to fill the place of English or American ash. A military board has decided that it is the most suitable Australian wood for ammunition boxes. The wood yields a yellow dye. *F. maculosa* (Leopard Tree, so called from its spotted trunk) is a small tree (20-30 feet), found in the dry interior from New South Wales to Queensland. In its early stages it is a tangled mass of long thin branches which, though not prickly, form a hedge, so that stock can prune but do not destroy the plants. Later a leading shoot emerges, protected by the encircling tangle of branches, which gradually atrophy; this main shoot develops into the trunk of the tree. In some cases the mass of branches persists for a long time near the ground; in others the branches at the ground level die off; or the whole of the early growth may disappear, leaving a clean barrel. It is an excellent fodder-plant, but requires careful pollarding, as its recuperative powers are not great It exudes a gum, which forms good adhesive mucilage, is pleasant to taste, and is eaten by the aborigines. This is a common bushman's remedy for diarrhoea.

Flounders, flatfishes of the family Pleuronectidae which, with the soles, differ from all others in having both eyes on the same side of the head. They are commonly confused with soles by fishermen, who apply both names indiscriminately to the same or to closely allied species. Flounders are characterized by having the margin of the preoperculum free and exposed, instead of hidden beneath the skin. One species (*Ammotretis rostratus*) is called 'sole' in Victoria and Tasmania, but is more correctly known in the Sydney markets as 'long-snouted flounder.' Several species of the genus *Pseudorhombus,* known as the large-toothed, small-toothed, and deep-sea flounder, find a ready sale in the markets, being delicate fishes for the table; unfortunately not enough of them are caught to supply the demand. Several species of the genus *Rhombosolea* are forwarded to the southern markets, where they are sold at a high price. The so-called Queensland Halibut (*Psettodes erumei*) has considerable economic potentialities, but has hitherto been taken in small quantities only by trawlers. It is a fine, fleshy fish, attaining a length of about two feet, and is one of the few flatfishes in which colour occurs as often on the left side as on the right. Its upper eye is close to the margin of the head.

Young flounders are bilaterally symmetrical, with an eye on each side of the head, and swim in an upright position. But at a very early stage of development they fall over upon one side, and the eye which then becomes the lowermost moves round towards its fellow, and distorts the skull in doing so. Normally the upper side alone is coloured, the lower being whitish; but individuals are occasionally encountered in which the lower surface is partly or entirely coloured like the upper. A.R.McC.

Flower-pecker. See MISTLETOE-BIRD and DIAMOND-BIRD.

Flycatchers, small perching birds with broad (sometimes very broad) bills surrounded by bristles, belonging to the family Muscicapidae. Birds of this family are confined to the eastern hemisphere, and are numerous in Australia. Though the typical members of the family are easily recognized by the characters mentioned, so many forms are intermediate between the flycatchers and the warblers, thrushes, and shrikes, that the limits of the family are

quite arbitrary, and every author has his own view as to what birds should be included in it. In this article only the more typical members will be treated—the species known in the vernacular as flycatchers and fantails. Fly-eaters, robins, thickheads, and other birds often placed among the Muscicapidae, will be dealt with separately.

Flycatchers, as their name implies, are insectivorous birds; they usually select perches from which they can watch for passing insects, flying out and catching them in the air and then returning to the same or another perch to repeat the operation. As they prey chiefly on the smaller day-flying insects, they must be counted among the most valuable of our birds, ridding us of great numbers of flies, mosquitoes, and other pests.

One of the most familiar species throughout a great part of the continent is the Brown Flycatcher (*Microeca fascinans*), familiarly known as 'Jacky Winter.' It is also called Peter-Peter, as its loud and cheerful call strikingly resembles these words repeated a number of times. But the best known is the Black-and-white Fantail (*Rhipidura leucophrys*), universally called 'Willy Wagtail.' This familiar bird frequents open bush country throughout Australia, but does not occur in Tasmania. It seems specially to delight in the neighbourhood of man and his domestic animals. Its song—which, though simple, is quite pleasing and is generally translated as 'Sweet pretty creature!'—it utters constantly during the day and frequently on moonlight nights. The wagtail's popularity is largely due to his bold and inquisitive nature. He is a constant attendant on all happenings about the homestead, perching on fence or gate or the ground, constantly wagging his long tail from side to side and springing up into the air to catch any insects that may be disturbed. When nesting he becomes especially daring, making vicious darts at the heads of human beings or animals that approach his chosen tree, and driving away birds much larger than himself should they have the audacity to settle in it or fly too near it.

The pretty little White-shafted Fantail (*Rhipidura flabellifera*) is one of the few small birds

Rufous Fantail.

found both in Australia and New Zealand. Like its larger relative the wagtail, it is a tame and inquisitive bird; but, instead of wagging its tail, it flutters about in the air, or among branches, with fan-like tail spread to its full extent. The lovely Rufous Fantail (*Rhipidura rufifrons*) has similar habits, but is much more retiring, inhabiting scrub and forest country.

The Restless Flycatcher (*Seisura inquieta*) bears considerable resemblance to the wagtail, but has no black on its throat. Its chief peculiarities are its habit of hovering in the air, and its curious harsh note, like the sound pro-

Restless Flycatcher.

duced in grinding tools on a wheel—whence it derives the name of 'scissors-grinder.' This note is frequently uttered, not only while hovering, but also when settled.

The remaining flycatchers on the Australian list are mainly birds of the tropical scrubs, and hence confined to the coastal districts of the north and east. The best-known are the Leaden Flycatcher (*Myiagra rubecula*) which migrates south to Tasmania, and the Black-faced Flycatcher (*Monarcha melanopsis*), which reaches Victoria. The most remarkable is the Boat-billed Flycatcher (*Machaerirhynchus flaviventer*), a little bird which has an enormously broad bill. It only comes south as far as Cardwell in northern Queensland.

Flycatchers construct beautifully neat cup-shaped nests of fine vegetable material, covered externally with spiders' webs. Those of the fantails (not including the wagtail) are further remarkable in the possession of a tail or stalk projecting downwards below the branch or twig on which the nest is placed. This appendage, which is variable in length, is generally left in a ragged condition, contrasting with the neat structure of the nest itself. About its object various suggestions have been made. Some authors maintain that it is for the purpose of making the nest less obvious and more like a casual collection of debris; others hold that it serves to increase the stability of the structure; a suggestion has also been made that is serves to drain off moisture. W.B.A.

Fly-eaters and Tree-tits, very small arboreal and insectivorous birds peculiar to the Australian region, belonging to the genera *Gerygone* (including *Pseudogerygone*) and *Smicrornis*. These genera are now usually placed

among the flycatchers (Muscicapidae) but seem to have equal or better claims to a position among the warblers (Sylviidae).

Both fly-eaters and tree-tits build domed nests, suspended either in bushes or among the twigs of trees. The nests are remarkable in possessing a projection over the entrance, forming a sort of hood or porch. Those of the fly-eaters have in addition a tail or appendage beneath, like those of the fantails (see FLYCATCHERS). They feed almost entirely on minute insects, in search of which they hop actively about among the foliage, meanwhile constantly uttering their songs—some of which take high rank in Australian bird-music, while all are pleasing. In the Australian bush they occupy the position filled by the wood-warblers (Mniotiltidae) in North American forests, and by warblers ('willow-wrens') of the genus *Phylloscopus* in European woods.

The Short-billed Tree-tit (*Smicrornis brevirostris*) has the distinction of being the smallest Australian bird. It is fairly common in southern Australia, but keeps largely to the tree-tops, so that it is little seen. The White-throated Fly-eater (*Gerygone albogularis*) of south-eastern Australia is a charming little song-bird, often

Bush Canary.

called 'bush canary'—not altogether inappropriately, as it has a bright yellow breast. In southern Queensland the same term is often applied to the Singing Fly-eater (*Gerygone cantator*), which chiefly inhabits mangrove belts along coastal creeks. The Brown Fly-eater (*Gerygone richmondi*) is common throughout south-eastern Australia. The Western Fly-eater (*Gerygone fusca*), very common in south-western Australia, is there sometimes called 'singer.' With regard to this species it must be noted that Gould (q.v.) gave it the name *fusca* before he knew its habitat, and then in error transferred that specific name to the brown fly-eater of New South Wales, calling the Western Australian species *culicivora*. The original name is now officially restored to the western bird, and the eastern bird receives the name of *richmondi*.

W.B.A.

Flying-fishes, species of the family Exocoetidae, many of which occur in all temperate and tropical seas; about a dozen are known from Australian waters. They attain a length of 16 inches, and are excellent table-fish. They have the habit of leaping from the sea and skimming above its surface at great speed for distances up to several hundred yards, probably to escape the attacks of enemies; in order to maintain the weight of the body while in the air their pectoral fins are greatly enlarged, and the ventral fins also may be considerably expanded. It is uncertain whether flying-fish actually fly by moving their 'wings' at great speed, or whether they merely glide; it is probable that both methods are employed, since the relative sizes of the fins vary greatly in different species. The initial impetus is gained from the tail-fin before the fish leaves the water, and a flight is often prolonged if the tail touches the crest of a wave as the fish speeds over it. Flying-fish move in shoals near the surface of the sea, and are greatly preyed upon by larger fish and dolphins in the water, and by birds in the air. They are frequently attracted by the lights of ships at sea, and fly aboard at night, shattering themselves against the ironwork as a result of their velocity. This habit of flying toward a light is known to the natives of many parts of the South Seas, and they erect in their canoes a net or sail to catch the fish, which they attract with torches at night. See also GURNARDS.

A.R.McC.

Flying Foxes. See BATS.

Flying Opossums—also known as 'flying phalangers' and (rather confusingly) as 'flying squirrels,' a name properly belonging to a family

Flying Squirrel.

of true squirrels that has no representatives in Australia—are diprotodont marsupials of the family Phalangeridae, provided with a parachute in the shape of a fold of skin that extends between the fore- and hind-limbs and, when stretched by the extension of these limbs, enables the animal not actually to fly, but to glide obliquely downwards through the air as do the true flying squirrels.

The largest, the Greater Flying Opossum (*Petauroides volans*), is almost as large as the common opossum. It has long, soft, silky fur varying from black to ashy grey or creamy white above, white or yellowish below; large oval ears, hairy on the outside; hands and feet thickly fringed with black hairs; the tail prehensile, grey or blackish, with the lower surface naked for a short distance at the free end. The greater flying opossum is, apart from its power of 'flight,' very similar in habits to an ordinary opossum. It is found throughout

eastern Australia from Victoria to Queensland, and is by no means rare, but is seldom seen unless specially hunted for; during the day it remains concealed in hollows in dead trees, and at night seldom descends to the ground. Its food consists of buds, leaves, and twigs.

The Yellow-bellied Flying Opossum (*Petaurus australis*), which inhabits the coastal ranges of New South Wales and Victoria, is much smaller than *Petauroides volans*, though still of considerable size, the head and body being 12 inches long, the tail 13 inches. It has long fur, brown on the upper surface, and variously marked with orange and black; the under-surface is orange. The long tail is very bushy, especially at the base.

The Squirrel-like Flying Opossum (*Petaurus sciureus*) is distinctly smaller, the head and body being only about 10 inches long, and the tail about 11 inches. It occurs over a wider range from Queensland to Victoria. It has soft, silky, slightly woolly fur, pale grey above—with a distinct band of black or brown along the middle of the back—and white with a tinge of yellow below. The Lesser Flying Opossum (*P. breviceps*) has a wider range, extending into Arnhem Land; it is distinguished from *P. sciureus* by its smaller size, shorter fur, and other minor differences. A still smaller allied species, *P. papuanus*, occurs in New Guinea.

The Pigmy Flying Opossum (*Acrobates pygmaeus*) is a minute, mouse-like creature, the smallest representative of the phalangers. The head and body together are three inches long, the tail about the same; the body is covered with a soft, silky fur, greyish-brown above, yellowish-white below. The flying membrane is fringed with long hairs. The tail is fringed on each side with a row of strong hairs, giving it a feather-like appearance; the under-side of the tip is naked. *Acrobates* feeds on leaves, buds, and fruits, with an occasional insect; like its allies, it is nocturnal, and lies concealed during the daytime in a nest constructed of leaves in a hole in the trunk of a tree. Though seldom seen unless specially sought after, it seems common enough in forest country in Queensland, New South Wales, and Victoria.

Nearly related to the flying opossums of the genus *Petaurus*, but devoid of a flying membrane, is Leadbeater's Opossum (*Gymnobelideus leadbeateri*)—a rare form, the only known specimens of which have been obtained on the Bass River in Victoria. The striped opossums (*Dactylopsi'a*), which similarly lack a flying membrane, are also closely related to *Petaurus*; they range from New Guinea (*D. trivirgata* and *D. melampus*) to central Queensland (*D. picata*). Their general colour is white, with black longitudinal stripes. A long-fingered form, *Dactylonax palpator*, also occurs in New Guinea.

The Feather-tailed Opossum (*Distoechurus pennatus*) is a near relative of *Acrobates*, but is devoid of the flying membrane, and is of distinctly larger size. It occurs in Papua. See MARSUPIALS. W.A.H.

Flying Pieman, THE. See KING, W. F.

Fodder-plants. Besides the native grasses (which are dealt with separately) Australia has many useful fodder-plants, some of which have not yet received the attention that is their due. The best-known is the saltbush (q.v.), a name applied somewhat indiscriminately to salsolaceous plants of six genera, one of which (*Rhagodia*) is endemic in Australia. Many wattles (*Acacia*) are valuable fodder-plants; some are becoming rare because stock eat down the seedlings. *A. aneura* (Mulga), sometimes called the 'king of fodders,' occurs in all the mainland States. *A. doratoxylon* (Spearwood or Carrawang) grows in all the States except Tasmania and Western Australia. *A. implexa* (Hickory) occurs in the three eastern States. *A. pendula* (Myall, called also Boree in southern New South Wales), extends also to Queensland, and is a great stand-by for sheep in dry seasons. *A. salicina* (Native Willow, Cooba, or Motherumba), now becoming scarce, occurs in all the mainland States. The portulaca family, including the genera *Calytonia* and *Portulaca*, are succulent spring and summer plants; *P. oleracea* (Pigweed), which the aborigines called 'munyeroo' and used for food, is readily devoured by stock. Among the Leguminosae, besides the wattles already mentioned, the Darling pea (*Swainsona*) and its relatives are nutritious and palatable, but appear at certain seasons to develop injurious narcotic qualities; they are therefore discussed under NOXIOUS PLANTS. A very useful legume is *Trigonella suavissima* (Menindie Clover), which is found throughout the interior of the continent from the Murray River to Shark Bay. Among the edible eucalypts are the Sugar Gum (*Eucalyptus corynocalyx*).

The Sapindaceae of fodder value include the Cattle-bush or Whitewood (*Atalaya hemiglauca*), Hop-bush (*Dodonaea lobulata*) and Rosewood (*Heterodendron oleaefolium*), but the last-named occasionally secretes excessive amounts of prussic acid in its leaves.

From the Cruciferae we have several species of *Brennodia*, particularly *B. lasiocarpa* (Mustard-plant), which affords good feed in the spring and early summer, and the widely distributed pepper-plants (*Lepidium*). The Geraniaceae are represented by the Native Crowfoot (*Erodium cygnorum*), a valuable spring fodder which the first hot wind scorches out of existence, and the Native Geranium (*Geranium dissectum*), which is less prolific. The Tar-wine (*Boerhaavia diffusa*), a valuable drought-resistant summer herb, much appreciated by stock, belongs to the Nyctagineae. The Meliaceae provide two good fodder-trees, *Flindersia maculosa* (Leopard-tree) and *Owenia acidula* (Native Nectarine or Emu Apple); and the Myoporaceae two more, *Myoporum platycarpum* (Dogwood) and *Eremophila longifolia* (Emu-bush). Among the Rutaceae occurs the Wilga (*Geijera parviflora*) a small umbrageous tree common in the inland pastoral country, which is so closely cropped by sheep as to become a symmetrical and even artistic feature in the landscape. Other useful trees or shrubs are Butter-bush (*Pittosporum phillyroides*), found in all the States and a good stand-by in time of drought; Native Currant (*Apophyllum anomalum*); Supplejack (*Ventilago viminalis*); Quandong (*Fusanus acuminatus*); and Belah (*Casuarina Cambagei*). Useful herbs not yet mentioned are the Native Carrot (*Daucus brachiatus*), a comparatively small plant, but palatable, nutritious, widespread, and available in the early spring; Rib-grass (*Plantago varia*), valued for its medicinal qualities, abundant in all the States, and especially common in association with *Danthonia* and *Stipa* pastures (see GRASSES); Hairy-head (*Ptilotus*) and Nardoo (*Marsilea quadrifolia*). E.B.

Football. Australia holds a probably unique position in the world of sport in that it is the home of four well organized codes of foot-

ball. In general terms the number might be reduced to three, since the Rugby League game is just as much 'Rugby' as the Rugby Union, though the Rugby League game requires fewer players and is maintained on a professional basis. The two other forms are the Australian game, and British Association (commonly known as 'Soccer'). The Australian game is popular in all States except Queensland and New South Wales, the Rugby Union strongest in New South Wales and Queensland (which has, however, adopted the League form in the last few years), and Rugby League and Soccer in New South Wales.

The Australian Game.—The first press notice of football in Australia appeared in the Sydney *Monitor* of 25 July 1829, where it is referred to as 'an amusement of the military' and 'much played in Leicestershire.' It is known that football was played in some form or other in the forties, but the first real effort to establish order in the control of the game appears to have been made in Melbourne in 1858, and included startling innovations in the rules recognized in England. The pioneers of the game were H. C. A. Harrison, W. Hammersley, J. B. Thompson, and T. W. Wills, an old Rugbeian; Harrison, a famous athlete in his day, is still living and actively interested in both football and cricket. These gentlemen founded the Melbourne Football Club, which was soon followed by the establishment of clubs at Richmond and South Yarra. Little interest, however, was taken in the game, which was from all accounts dangerous and brutal; hacking (i.e. deliberately kicking at an opponent) and tripping were not offences. Rough as football is to-day, there are fewer physical dangers in the game than there were at this early period. The rules were few, and the players' uniforms nondescript. Between 1858 and 1866 many clubs were formed, and it became obvious that some system must be agreed on. Accordingly on 8 May 1866 delegates from the leading clubs met to formulate rules for the Australian game; these rules, with a few minor changes, are substantially those which govern it to-day. The delegates were H. C. A. Harrison and R. W. Wardill (Melbourne), the former acting as chairman; G. O'Mullane and H. Murray (South Yarra), B. James and T. Power (Carlton), and J. E. Clark and R. Chadwick (Royal Park). At this meeting the distance between the goals was increased from 170 to 200 yards, and running with the ball was limited by a regulation that it must be bounced every five yards (a distance afterwards increased to ten yards). In 1869 the practice of deciding a match when two goals had been obtained by either side, in however brief a time, was altered to the present system of fixing a time-limit for the game. In 1872 a further conference ordained the change of sides at half-time, and insisted that all disputes on the field should be referred to a field umpire. In 1876 the Victorian Football Association was formed with W. T. Clarke as president, H. C. A. Harrison and R. Robertson as vice-presidents, H. H. Budd as secretary, and T. P. Power as treasurer. But the Association was never really popular, and in 1897 the Carlton, Collingwood, Essendon, Fitzroy, Geelong, Melbourne, South Melbourne, and St. Kilda clubs broke away and formed what is now known as the Victorian Football League, which because of its strength became the controlling body in Victoria. The Association still exists, the outer suburbs being represented on it.

From Victoria—which has always been its headquarters—the Australian game has gradually spread to Tasmania and South and Western Australia, where it has pride of place. In New South Wales the game has never been popular. An attempt made in 1878 to interest Sydney in the new game gained a few supporters, mainly because a team from Carlton had visited Sydney in 1877 and played an exhibition game with a team of Rugby players. In 1880 Victorians living in New South Wales succeeded in fixing a match between Rugby players and 'old Victorians' at Moore Park, and in the following year two clubs (Sydney and East Sydney) were formed and a team sent to Melbourne. A second team went to Melbourne in 1886, and the game was witnessed by 12,000 people. The Melbourne authorities did what they could to foster the game in Sydney by sending teams over, but enthusiasm ebbed steadily, and in 1897 the game ceased to be played. In 1903 it was revived, and League teams from Collingwood and Fitzroy played one of their premiership matches in Sydney; soon afterwards the New South Wales Football League was formed, and in 1912 obtained a large ground of its own at Botany. No official inter-State matches have been instituted, but since the war teams representative of Victoria and New South Wales have exchanged visits twice a year, and teams from other States also visit Sydney. In 1907 a league playing under Victorian rules was founded in Queensland, but progress there has been slow.

The first intercolonial match was played between Victoria and South Australia on 1 July 1879, when Victoria won by 7 goals 14 behinds to 3 behinds. The two States now exchange visits yearly, and in 1925 a Victoria-Western Australia annual match is to be instituted. Since 1908 triennial championship matches have decided State supremacy in the Australian game. In 1908 Victoria won the championship at Melbourne, in 1911 South Australia at Adelaide, in 1914 Victoria at Sydney, in 1921 (after an interval due to the war) Western Australia at Perth, and in 1924 Victoria at Hobart.

In 1897 the laws of the game were revised, and since then very few alterations have been made. The game is played with 18 men a side; the playing space is maximum 200 yards by 150, with a minimum of 150 yards by 100 yards; four quarters of 25 minutes each constitute the time of play; change over is made at the close of each quarter, and a rest of 15 minutes is permitted at half-time; there is no offside, and as soon as the ball goes out of bounds it is thrown in by a boundary umpire. Consequently the game is very fast.

Rugby Union.—In 1870 the first steps were taken to form in New South Wales a football club under Rugby rules. Five enthusiasts—R. A. Arnold, W. M. Arnold, T. Brown, Septimus Stephen, and G. Deas Thomson—formed the Wallaroo club, which within a short time was followed by the University, Burwood, St. Leonards, and The King's School clubs, and two years later by Waratah, Newington College, and Calder House clubs. The chief difficulty at first was to get a suitable ball to play with, the proper ball being unobtainable; a saddler, however, made a clumsy ball which did good service until one in accordance with regulations could be procured from the maker in England. Teams consisted of 20 players, and all disputes were settled by the captains. In 1874 delegates from the Wallaroo, The King's School, Newington College, Goulburn, Waratah, Balmain, North Shore, University, and Camden College formed the Southern Rugby Union. The

Rugby Union of England code of rules was adopted; J. J. Calvert became the first president of the Union, T. Brown (Wallaroo) and E. Barton (University) vice-presidents, and W. H. Fletcher treasurer and secretary. By 1880 the number of clubs had reached 100, and the game flourished everywhere. The Wallaroo club began to play 15 men a side, and very soon the practice was adopted by all clubs. The first intercolonial match under these rules was played between New South Wales and Queensland on 12 August 1882 at the Sydney cricket ground in the presence of 4000 people, and was won by New South Wales by 28 points to 4. In August 1882 a team from New South Wales visited New Zealand under the captaincy of E. Raper, and won four of the seven matches played. Since that year visits have been interchanged by teams from Australia and New Zealand, and inter-State matches between New South Wales and Queensland have taken place annually. In 1889, 1894, and 1895 Victorian teams visited Sydney but were only once successful in winning a game. Since 1895 Victoria has had no organized Rugby football. Some attempt has been made to establish the game of late years, but Rugby has no hold in Victoria.

International Football.—In 1888 the first British team under Rugby rules visited Australia; of nine games played in New South Wales seven were won and two drawn (against The King's School and the Sydney Grammar School). The captain of this team, R. L. Seddon, was during the tour drowned in the Hunter River, and the captaincy devolved on A. E. Stoddart, later and better known as a cricketer, who thus had the unique distinction of captaining an English team against Australia in both cricket (1894-5 and 1897-8) and football (1888). Four matches in Queensland and one in Melbourne were won, the visitors scoring 58 points to 15 in all. Of matches under Australian (then known as Victorian) rules seven were won and 12 were lost. In 1899 M. Mullineux—whom A. B. Paterson has celebrated in verse—brought out a team whose play set its Australian opponents a fine example and helped to raise considerably the standard of local football. A third team, under D. R. Bedell-Sivright, visited Australia in 1904, and a fourth (Harding's) in 1908. In 1908-9 the first Australian team to go abroad visited England and America; it was known as 'The Wallabies,' and comprised H. M. Moran (captain), Frederick Wood (vice-captain), W. Dix, C. Russell, H. Daly, J. Hickey, F. Bede Smith, E. Mandible, D. B. Carroll, A. J. McCabe, C. H. McKivat, Ward Prentice, J. M. Stevenson, J. T. Barnett, M. McArthur, E. McIntyre, T. Griffin, C. A. Hammond, P. H. Burge, A. B. Burge, P. A. McCue, S. A. Middleton, C. McMurtrie, N. E. Row, C. E. Murnin, P. Carmichael, C. E. Parkinson, T. J. Richards, F. Flanagan, K. Garvan and R. R. Craig. The team was defeated by a Welsh team (1 penalty goal and 2 tries to 2 tries), but defeated an English team (3 tries to 1): no Scotch or Irish players having been chosen in Harding's team, the Rugby Unions of Scotland and Ireland held aloof from the Australians' return visit, and matches were confined to England and Wales. Thirty-one matches in all were played, of which only five were lost (those against Llanelly, Midlands, Wales, Swansea, and Cardiff). Five matches played in America were all won, but the tour was a failure financially, the Union losing some £1400.

In 1910 a team from the United States visited Australia, but were beaten in five out of the eight matches played. The advent of the Rugby League, which is described below, deprived the Union game of a good deal of popularity, and during the war (1914-18) all official games were suspended, so that when in 1919 Union football recommended it was found very difficult to rearouse public interest; but the events of the 1924 season show that much of its old-time popularity has been regained.

Rugby League football originated in 1907 from a dispute within the Union as to the adequacy of the allowance for out-of-pocket expenses; the Union at that time allowed to players on tour only 3s. per day, and several popular players demanded more, and went on to suggest that payments should be made even for matches in the home town on the lines of the English Northern Union arrangement. This at once raised the whole question of professionalism, and a Rugby League was formed which agreed to pay its players 10s. per day and 7s. 6d. for out-of-pocket expenses. The Union authorities thereupon declared all League players professionals, and expelled them. A similar movement had already split New Zealand football, and a team from the Dominion visited Sydney in 1907 and won three games against the new League's team. In 1908 a League team ('The Kangaroos') of 34 players, with D. Lutze as captain and H. H. Messenger as vice-captain, visited England, where it won 18, lost 22, and drew 6 matches. A second team visited England in 1911 under the captaincy of C. McKivat; the tour was a financial failure, but of 35 matches 28 were won, 5 lost, and 2 drawn. In 1910 a Northern Union (England) team came out under J. Lomas, and won 8 matches, lost 4, and drew 1. A team from New Zealand visited New South Wales in the same year, and in 1912 a New South Wales team visited New Zealand, winning 8 out of 9 games. In 1920 an English team under H. Wagstaffe toured Australia, and in 1924 one under J. Parkin. The first match of Wagstaffe's team against Sydney drew a record 'gate' for a Rugby match —67,739 spectators, producing £5740. The League has spread from New South Wales into Queensland, where it has almost entirely displaced the Union game.

Among the more important changes in play introduced by the League are the abolition of two forward players (reducing the team to 13), the prohibition of kicking out of touch on the full, and an increased stringency with regard to off-side play round the scrum. In 1923 it was further ruled that no goal could be obtained from a mark, and that the touch judge may intervene in the progress of a game if he wishes to report foul play to the referee.

British Association (Soccer) football was first played in Australia in 1880, when the game was introduced to Sydney and the New South Wales Association was formed. It gradually spread to the other States, and its progress since the war has been rapid. In 1923 there were 450 Soccer clubs in New South Wales, with a playing membership of 7000; Victoria had 24 clubs, South Australia 21, and Queensland 21 in the Moreton Bay area alone. The governing body is the Football Association (Australia), on which all the States are equally represented. In 1921 an Australian team visited New Zealand, winning two test matches and drawing one; in 1922 a New Zealand team visited Sydney and won two out of three test matches. In the same year a team of Chinese university students (with a few

other Chinese) visited all the States except Western Australia; of five test matches the visitors won one and lost three, one being drawn. In 1923 a Canadian team visited the four eastern States, won two test matches and lost three, the sixth being drawn. Australian Soccer is played under British rules, but a local additional rule in New South Wales allows the replacement before half-time of an injured player, provided the consent of the referee and the captain of the opposing team has been obtained. J.V.C.-B.

Forbes, Sir Francis (1784-1841), born at St. George in the Bermudas in 1784 and educated in his native town, went to England at the age of 19, was admitted to Lincoln's Inn on 26 May 1806, and called to the bar in 1812. In 1813 Lord Bathurst made him attorney-general of the Bermudas, and in 1816 he became the first chief justice of Newfoundland. Having satisfactorily established the new judicial system in that colony, and finding the climate too severe for a long stay, he in 1822 returned to England on leave and was offered by Bathurst the chief justiceship of New South Wales. He was repeatedly consulted during the preparation of the New South Wales judicature act (4 Geo. IV, cap. xcvi), was appointed chief justice on 1 June 1823, and received his formal commission on 13 October. Five months later, on 13 March 1824, he landed at Sydney, promulgated the charter of justice on 17 May, and on the same day took his seat on the bench and opened the new supreme court. He had already (on 1 December 1823) been appointed a member of the legislative council, and on 20 December 1825 became a member of the executive council also. These were more or less political positions, which conflicted with his position as a judge; and the conflict was emphasized by the bestowal on him of an exceptional power with regard to legislation, against which he had protested vigorously before leaving England. As chief justice he was required, before any bill was submitted to the legislative council, to certify that it was not, in his opinion, inconsistent with the laws of England. This requirement, as he himself said, gave him a power of veto over proposed legislation.

During Brisbane's administration there was no friction between governor and chief justice; but Darling held strongly the view that his councillors—and Forbes as one of them—ought to support his policy. Forbes, holding aloof from politics and exercising his power of veto with strict conscientiousness, was soon brought into collision with the governor. In July 1825 the colonial office directed Darling to introduce a bill for licensing the colonial press, as an indirect method of reimposing a censorship on it. When the bill was submitted to Forbes for his certificate, he considered its terms inconsistent with existing English law, and recommended that it be submitted to the British parliament, which alone could alter existing law. Darling in December 1826 accepted this recommendation; but when Forbes early in 1827 refused his certificate to a bill imposing a stamp duty on newspapers, and the local press in some way (certainly not from Forbes himself) obtained this news and used it as a weapon against the governor, Darling grew restive. During the year he attacked the chief justice bitterly in despatches; but the colonial office was in 1827 under three different ministers, and the despatches (as well as letters from Forbes setting forth his side of the case) were not dealt with until Sir George Murray assumed office in May 1828. Murray on the advice of his law officers decided (*a*) that Forbes was right as regarded the licensing bill, but probably wrong—though conscientiously so—as regarded the stamp bill, (*b*) that in regard to several minor complaints both parties had made mistakes, (*c*) that if the dissensions continued he would recall both the judge and the governor, and (*d*) that, as a matter of high policy and without reflecting on Forbes personally, the chief justice must cease to be a member of the executive council.

Forbes meanwhile had persistently held himself aloof from partisanship of any kind, and had actively supported Darling where he saw a just occasion—e.g. he denounced the attacks on the governor in the case of Sudds and Thompson (see Darling, Sir R.) as 'a political juggle.' In April 1829 there was a formal reconciliation between governor and judge, but the unofficial friction continued until Darling's departure in 1831. Forbes's health had never been good, and was sadly impaired by the long controversy; even Bourke's friendship and support could not restore the failing strength. In 1835, finding that he could not get through a single term's business without serious illness, he obtained leave of absence, but delayed his departure for six months to obviate a dispute between the two puisne judges as to which of them should officiate as chief justice in his absence. In April 1836, yielding to the persuasions of Bourke, he sailed for England; but the delay had been fatal, the disease (which involved paralysis of the left arm) fastened on him and proved incurable, and in May 1837 he resigned his post and was granted a retiring allowance of £700 a year. In 1838, after appearing as a witness before the parliamentary committee on transportation, he returned to Sydney, and died there on 9 November 1841.

His name is inseparably connected with the introduction into New South Wales of trial by jury in the ordinary sense of the word. The act of 1823 ordained the establishment of courts of quarter sessions, and Forbes in October 1824 decided that this involved the summoning of juries. The local magistrates, whose duty it was to frame lists of jurymen, confined themselves to free settlers and officials, omitting the names of all emancipists. Brisbane in 1825 was inclined to advocate the admission of emancipists, but forbore to do so officially, and Darling opposed the suggestion vehemently. It was not, therefore, until Bourke's advent that Forbes could have his way; but in 1833 he and the other judges (Dowling and Burton) decided that all free persons, whatever their former state, were entitled to all the privileges of free men. Forbes's excellence as a judge is eulogized by Roger Therry (q.v.), who ascribes to him (*Reminiscences*, p.335) 'judicial qualities of a high order—imperturbable calmness of temper, acute discrimination, and a thorough acquaintance with legal principles,' adding instances of his 'masterly analysis of evidence.' His interest in education took active shape in his work towards the founding of the Sydney College; and his value to the colony as a citizen is best shown by Bourke's declaration to Roger Therry after his death:—'If I had any success in removing abuses and opening the way to a better course of government in the colony, to the assistance I received from Forbes I am mainly indebted.' (Kt. Bach., 1837.) See Judiciary.

Forest Mint. See Mentha.

Forestry. Except for extensive areas of soft-woods in Queensland and Tasmania—and, to a less extent, in the coastal belt of New South Wales—the natural Australian forests consist of hard-woods. The principal forest areas occur in the eastern and southern portions of the continent, in Tasmania, and in the south-western area north and east of Cape Leeuwin. In the main these forests are mountain products. In Queensland they lie between the seaboard and the Great Dividing Range, and on the crests and slopes of the mountains. In New South Wales the wide plains of the Murrumbidgee, Lachlan and Darling districts are bare, but the rest of the State is wooded, the largest timber being found on the coastal slopes. Owing to the extent of its mountain territory and its ample rainfall, Victoria is one of the best-wooded of Australian States. Except on peaks above the winter snow-line the mountains are well-covered; thin forests extend also across the northern plains, and belts of red gum occur along the course of the Murray and in the valleys of its tributaries. The Otway and Gippsland districts, south and east of the main divide, are also luxuriantly wooded. Forest areas in Tasmania are widely distributed over the island, soft-woods being found chiefly in the western and southern districts. In South Australia the forests, less luxuriant than those of the eastern States, are restricted to the hills surrounding Adelaide and the Yorke and Eyre peninsulas. In Western Australia there is a forest-belt stretching from the Leeuwin north to the Murchison River and east to Albany; jarrah forests extend eastward from the Darling Range, and in the north-west the King Leopold and St George's ranges are well-covered. The rest of the State is bare. Small forests also occur in the Northern Territory and round the Gulf of Carpentaria.

No complete survey of state forest lands has been made on a uniform basis, but it is estimated that the total forest area approximates 69,054,000 acres, only 3.63 per cent of the total area of the Commonwealth. There are no means of determining the original forest wealth of Australia, but doubtless much of it has been destroyed in the process of settlement. It has been estimated, for example, that the forests of New South Wales, which now cover 11,000,000 acres, extended 100 years ago over 30,000,000 acres. During the early years of settlement some protection against indiscriminate destruction was afforded to the forests in the interests of the British navy, all timber suitable for naval purposes being reserved in early land-grants to the Crown. In 1795 Governor Hunter was moved to take action against the destruction of the forests in the Hawkesbury district; he forbade the felling of timber on ground not marked out or allotted to individuals, and again ordered that no trees marked as suitable for the navy should be cut. The first recorded shipment of timber on a large scale for use 'in His Majesty's dockyards' was made in 1804. But with the close of the Napoleonic wars the timber requirements of the British navy were reduced; the pressure of settlement was already making itself felt, and henceforth the interests of forestry throughout Australia were entirely subordinated to those of settlement. Additional destruction was occasioned by the unregulated activities of timber-getters. In 1824 Governor Brisbane directed the attention of the colonial office to the advantage that would accrue to settlers if they could find a market abroad for Australian timbers—a fact which local merchants had already recognized. By 1827 the governor found it necessary to charge ½d. a foot for cedar cut on crown lands to meet part of the extra cost of policing the cedar-cutters in the coastal districts of New South Wales, among whom great disorder frequently occurred. During the next 50 years the valuable red cedar forests of the continent's north-eastern coast were laid waste. In Western Australia, also, no adequate regulations controlled the activities of settlers, who exploited the jarrah and sandalwood belts to tide them over the years of unproductive agriculture.

Public interest in the conservation of forest resources seems not to have been aroused in Australia until 1871, when the initiative was taken by South Australia. During the next 40 years halting attempts were made to develop a forestry policy in the various States. In South Australia the government was requested in 1871 to furnish parliament with a return showing the supply, preservation and culture of forests in the colony; in 1873 it agreed to subsidize the planting of trees by landowners, and in 1875 a forest board was appointed and provision made for the reservation of forest areas. The forest board soon established small plantations of soft-woods, especially of *Pinus insignis*, which was first introduced into the colony by Baron von Mueller; but its activities were continually hampered by insecure tenure and lack of funds. It was not until 1903 that certain reserved forest areas were made inalienable except by vote of both houses of parliament. The need of trained forest officers led to the institution of a course in forestry at the university of Adelaide. In New South Wales the destruction of the red cedar forests on the north coast and the red gums along the Murray was such an obvious waste of valuable resources that the government in 1871 established a number of forest reserves in which timber should be cut only under licence; these reserves, however, could be easily revoked. A forest ranger was appointed in 1875, and in 1877 forest regulations were issued and a forest-conservation branch of the public service constituted for administrative purposes; but this branch was transferred from department to department in a way that made continuity of policy impossible. In 1889 a department of forestry was created, and a director-general of forests appointed; he was not, however, a trained forester, and administrative expenses far exceeded the forest revenue, with the result that the department was again reduced to a branch service. No active policy was adopted until 1895, when a trained forester was appointed to control the service; his powers were limited, and he was opposed by vested interests; but he was able to show that money well spent in the care and management of forests would be amply repaid. He aroused so much public interest that in 1907 a royal commission was appointed to examine into the forestry position. They recommended a vigorous policy of conservation and afforestation, and pointed out the necessity of adequate forestry legislation, better supervisory machinery, and the permanent dedication of approved forest lands. As a result a forestry department was again created and a forestry act passed in 1909; but the powers of the department under the act were very limited.

In Victoria the conservator of forests, who was appointed in 1887, tried without much success to prevent the alienation of good forest land

for settlement purposes; he was, however, able to establish some coniferous plantations, and soft-woods are now being cut in Victoria, as well as in South Australia, from forests thus planted. In 1907 the Victorian parliament passed a forestry act under which a forests department was created, with exclusive control of forest policy; the conservator was made directly responsible to a minister, and was given the management of reserved forests, timbered lands, plantations and nurseries. Provision was made for the reservation of permanent forest areas, inalienable except by special act of parliament; the training of forest officers was also provided for, and a school established at Creswick for primary training in forestry. Under the act working plans regulating the felling and output of timber from the reserves were put in force. An inspection of Victorian lands for demarcation purposes was made by the district surveyor and a forest officer jointly. Until 1916 the Victorian forestry policy was more advanced than that of any other State.

In Queensland a public meeting was held in 1873 to consider the question of forest conservation, and the government was induced to appoint a select committee to consider and report up the best means of preserving and promoting the growth of timber trees and of conserving forests for useful purposes; but the committee made only a few desultory recommendations, inadequate for the initiation of a continuous forest policy. A forest act of 1906 provided for the establishment of a forestry service, under a director of forests; the governor was empowered to reserve areas as state forests or national parks.

In Western Australia a forestry department administered certain regulations for the control of forests which were inserted in the land act of 1898. Under the act the government was authorized to reserve from sale any crown lands that might be required as forest areas, but the regulations did not specifically provide for forest management in any other way than by the issue of timber and other licences and leases.

In Tasmania, where the timber trade had been carried on actively since the forties, no effort was made to initiate a forestry policy until 1885, when a conservator of forests was appointed under the deputy commissioner of crown lands; he resigned his position after two years' service, and his place was not filled. The lands department thenceforth administered such forest regulations as were issued, especially those attached to the crown lands acts of 1903 and 1905. Timber reserves of an estimated area of 1,500,000 acres were proclaimed; the land could not be sold or used for settlement until the valuable timber had been removed, unless the reserve were revoked by a proclamation in the *Gazette*.

In 1911, after the States had been experimenting in forestry for 40 years, the responsible forestry officers decided to pool their experience by holding the first of a series of inter-State conferences. It was agreed that in none of the States was there forestry legislation comprehensive enough to ensure the conservation, maintenance, and planting of forests; that there was need for more adequate provision for the creation of permanent and inalienable reserves; and that management should be vested in a permanent authority endowed with statutory powers. Only in Victoria and South Australia had any provision been made for the training of foresters, and there was an obvious need for a more comprehensive educational scheme. Most States had acts providing for some degree of fire-protection, but it was generally recognized that these were inadequate. In order to secure the passage of further legislation necessary to carry out a vigorous and continuous forestry policy, it was resolved that an unofficial Australian Forestry Association should be formed 'to awaken the people and the several State governments to the enormous waste of forest resources and to the lack of effective provision for the requirements of the future.' As a result of this and subsequent inter-State conferences (held in 1912, 1916, 1917, 1920, and 1922), and of the public interest roused by the propaganda of the Forestry Association (formed in 1912) and by the direct inspiration of Sir Ronald Munro-Ferguson—a trained and widely-experienced forester who was governor-general in 1914-20—there has been a rapid advance in Australian forestry during the past decade. Comprehensive legislation has been passed or is under consideration in all the States. The first effective move was made in 1916 by New South Wales. The control of forest policy in that State was vested in a board of commissioners who, within the limits of their statutory power, were freed from political control; they were empowered to carry out a policy which they themselves were to devise, to reserve not less than 5,000,000 acres of crown land as state forests, and to spend on forestry improvements (exclusive of administrative expenses, which are voted by parliament) 50 per cent of the forest revenue. The commission, before laying down working plans, began a systematic organization of state forests and a survey of forest resources with a view to making permanent reservations. It is hoped that 5000 acres of coniferous plantations will be laid down annually for the next 20-30 years. A forest school has been established at Narara near Gosford, where a two years' course in scientific forestry is provided. Control of forest policy by a commission was adopted in Victoria in 1919. In Western Australia an expert was appointed in 1916 to reorganize the forestry department, and in 1918 was passed a forestry act on lines laid down by the inter-State conferences. In Tasmania a conservator of forests was appointed in 1919, and a separate forestry department was established; after the inter-State conference held in Hobart in 1920, a forestry act was passed, of a less comprehensive character than the Western Australian. In Queensland no legislation has been introduced since 1906; but an adverse report on the State's forestry policy made by Sir David Hutchins in 1915 resulted in great administrative improvements. In 1922 the inter-State conference was held in Brisbane, and the forestry officers and ministers there present pointed out the necessity for more up-to-date legislation in Queensland, on the lines now adopted in the other States.

The functions of forestry authorities in the various States include the care and management of natural forests, the exercise of strict control over the operations of timber-getters, and the provision of adequate fire-protection. In States deficient in soft-woods the departments are taking measures to establish coniferous plantations, the lack of which is seriously felt throughout the Commonwealth. In 1922-3 there were 134 acres of nurseries in Australia; 4412 acres of forest were planted during the year making the total area of effective plantations

47,359 acres, of which about 39,000 acres were in South Australia and Victoria.

Surveys of natural forest areas are also being made with a view to enlarging the permanent state forests. At the inter-State conference of 1920 it was estimated that to meet the future requirements of Australia 24,500,000 acres of forest would be necessary. This figure has since been adopted as the Australian forest ration, and the reservation of that area is now being expedited on the following basis of distribution:—New South Wales, 8,000,000; Victoria, 5,500,000; Queensland, 6,000,000; South Australia, 500,000; Western Australia, 3,000,000; Tasmania, 1,500,000. The area of state forests reserved in perpetuity totalled in June 1923 10,412,637 acres, of which 5,315,689 acres were in New South Wales, 3,401,738 in Victoria, 1,410,364 in Queensland (exclusive of the 153,540 acres of national parks), 203,258 in South Australia, 52,389 in Western Australia and 29,199 in Tasmania. In addition to the state forests each State maintains a number of timber reserves, which can, however, be easily cancelled. The area of these reserves in 1923 was 7,836,499 acres; the total area controlled by the forestry departments of the various States was 18,500,000 acres. This total includes inaccessible mountainous country and cut-over lands, whereas the agreed-upon quota only refers to merchantable forest.

Since 1911 forestry officers have been agreed upon the necessity of improved facilities for training foresters, and have favoured the establishment of an Australian school of forestry supported by the Commonwealth and State governments jointly. The Commonwealth has decided to establish this school in the Federal Capital Territory; its diploma course will be a two-year one, and will supplement and develop the training now given by the schools at Gosford in New South Wales, Creswick in Victoria, and Ludlow in Western Australia. An Australian forest products laboratory has already been instituted at Perth, with the aid of the Commonwealth government.

The revenue and expenditure of the various forestry departments in 1922-3 was:—

	Revenue	Expenditure
New South Wales	£168,698	£137,108
Victoria	163,076	138,714
Queensland	267,816	158,618
South Australia ..	8,362	40,822
Western Australia	87,658	38,827
Tasmania	19,346	8,293

Forrest, Alexander (1849-1901), born in Western Australia in 1849 and trained as a surveyor, came into public notice when he accompanied his elder brother John (q.v.) on his expedition from Perth to Adelaide via Eucla in 1870. In 1871 Alexander was entrusted with the leadership of a party selected to explore the country E. and S. of Hampton Plains. This and his other explorations are described under Exploration by Land. In 1874 he was second in command of John's expedition to the Murchison and Fitzroy, and other rivers, being specially selected for reconnaissance work in connection with the colonial survey. His most important exploration was undertaken in 1879, when he opened up the Kimberley district, 25,000,000 acres of which he reported suitable for pastoral development or tropical agriculture; a special land regulation was therefore issued in November 1879, and an immediate development of settlement took place. Thenceforth Forrest abandoned exploration for commercial and political work. In 1886 the newly-formed Kimberley electorate sent him to the legislative council, and in 1887 he was the acknowledged leader of the country protectionists, who demanded duties on the importation of live stock rather than of manufactures. He won the West Kimberley seat in the first elections under responsible government (1890), and represented his colony at the federal convention of 1891. He died in 1901.

Forrest, Baron. John Forrest, first baron Forrest of Bunbury (1847-1918), third son of William Forrest, was born on 22 August 1847, and educated at the Bishop's School at Perth in Western Australia. At the age of 18 he entered the colony's survey department, and in 1869 was given charge of an expedition into the interior to search for traces of the missing explorer Leichhardt. In 1870 he led an expedition from Perth along the Bight to Adelaide, and in 1874 traversed the colony from Champion Bay to the overland telegraph line between Adelaide and Port Darwin, a distance of over 2700 miles (for all these journeys see Exploration by Land). These services gained for him the gold medal of the Royal Geographical Society of London, as well as the title of Chevalier of the Order of the Crown of Italy, and honorary fellowship of the St. Petersburg, Vienna, and Italian Geographical Societies. He also received the thanks of the colonial government, and a grant of 5000 acres from the Imperial authorities. In 1876 he was appointed deputy-surveyor-general; in 1878-9 he was acting commissioner of crown lands and acting surveyor-general, in 1880-81 acting comptroller of government expenditure; from 1883 to 1890 he was commissioner of crown lands and surveyor-general, with a seat in the executive and legislative councils. With the introduction of responsible government (in securing which he took a prominent part) he became first premier and colonial treasurer of the colony, a position which he held without interruption for nearly 11 years, relinquishing office only to undertake wider duties in the first federal parliament. During his term of office notable gold discoveries were made in the colony, and a great expansion took place. To his strong purpose and wide outlook during this period are due the goldfields water scheme, the Fremantle harbour works, the development of the railway system to the mining areas, and the liberal land legislation of Western Australia.

He was a member of both federal conventions, that of 1891 and that of 1897-8; he also represented his colony in the federal councils of 1893-5-7-9, being president in 1897. In 1901 he was elected to the federal house of representatives for Swan, and retained the seat till his death. In the first federal ministry he held successively the positions of postmaster-general (1901) and minister of defence (1901-3); from September 1903 to April 1904 he was minister for home affairs, treasurer from July 1905 to July 1907, acting prime minister from March to June 1907, and treasurer again from June 1909 to April 1910, and from June 1913 to September 1914. When in 1917 W. M. Hughes formed a coalition ministry to carry on the war, Forrest was again treasurer, but retired in March 1918. In February a peerage had been conferred on him. He died at sea on 3 September 1918.

Forrest's great work was his development of Western Australia during his long premier-

ship. In the debates of the federal conventions he took part mainly as champion of the smaller colonies, and during his federal period remained a striking figure, but scarcely an active deviser of policies or a progressive administrator. Indeed, his value as treasurer was mainly due to his conservative tendencies. The transcontinental railway from Port Augusta to Kalgoorlie, which he had advocated before the Commonwealth came into existence, he thereafter continued to advocate as the one sure link between the eastern States of the Commonwealth and their isolated western partner. In England he was well known and popular. He made official visits at both Queen Victoria's jubilees, at the coronation of Edward VII and at that of George V, and shared in the honours distributed on those occasions. (C.M.G., 1882; K.C.M.G., 1891; P.C., 1897; G.C.M.G., 1901.)

Forster, JOHANN REINHOLD (1729-1798), descendant of a Yorkshire cavalier family that settled in Polish Prussia after the death of Charles I, was born at Dirschau near Danzig in 1729, and in 1754 was Lutheran minister at Nassenhuben. In 1765 he abandoned the ministry for a scientific career, visited Russia, and in 1766 settled in England as assistant-master at Warrington school in Buckinghamshire; in 1770 he moved to London (at the suggestion of Alexander Dalrymple) and embarked on literary work, translating in 1772 the Comte de Bougainville's *Voyage Round the World*. In the same year he was made a fellow of the Royal Society and joined Captain Cook's second expedition as naturalist, taking with him his son Georg to make the necessary drawings. On their return the two published the result of their researches as *Characteres Generum Plantarum* (1775). The plants on which this was based were given to Sir Joseph Banks, and are now in the British Museum. It had been intended that Forster should write the account of the second voyage as Hawkesworth had that of the first; but difficulties (mainly temperamental) cropped up, and in the end Cook wrote the book himself, Forster being forbidden by the admiralty to write anything. He therefore set Georg to work, and his account was published in 1777 a few months before Cook's appeared. This breach of discipline ended the Forsters' English career, and they returned to Germany. From 1780 to 1798 Reinhold Forster was professor of natural history and director of the botanical gardens at Halle; he also translated and edited for German consumption the Pacific voyages and journals of Cook, White, Bligh, Hamilton and Hunter. After his death in 1798 his library was acquired by the royal library at Berlin.—His son JOHANN GEORG ADAM FORSTER (1754-1794), already mentioned (better known as George Forster), was born at Nassenhuben on 27 November 1754. He accompanied his father to the Pacific, and in 1776 was made a fellow of the Royal Society for his share in the *Characteres*. His drawings of animals and plants made during the voyage were in 1776 purchased by Banks for £400, and are in the British Museum. He seems, however, to have made many duplicates, and had at least 30 redrawn in London by a more skilful artist for presentation to George III; a good many of these came into the possession of Cook's cousin Isaac Smith (q.v.), and are now in the Australian Museum at Sydney. In 1778, just before leaving England, he published *A Letter to the Right Honorable the Earl of Sandwich*, which set forth fully and with some virulence the Forsters' side of the quarrel with the admiralty. After his return to Germany Georg was professor of natural history at Cassel (1778-84) and Wilna (1784-8), and in 1788 was made custodian of the library at Mayence. In 1786 he published a treatise on the edible plants of the South Sea islands, and in 1790 toured western Europe with Alexander von Humboldt; in 1793, France having advanced her boundaries to the Rhine, he was sent as deputy from Mayence to the national convention in Paris, and died there of a fever on 10 January 1794.

Forster, WILLIAM (1818-1882), was born at Madras in 1818 and brought to Australia in 1829 by his father, Dr. T. Forster of the 50th regiment, who settled at Brush Farm near Parramatta. He was educated by W. T. Cape, and became a squatter, but in his leisure hours composed political satires (chiefly directed against Sir G. Gipps) for the squatters' organ, the *Atlas*; this newspaper disappearing at the end of 1848, Forster was from 1850 onwards a contributor to Henry Parkes's *Empire*. When New South Wales obtained responsible government, Forster was sent to the first assembly by the Murray electorate, and so commenced an uninterrupted parliamentary career of 20 years, during which he represented the Murray (1856-9), Queanbeyan (1859-60), East Sydney (1861-4), the Hastings (1864-9), Queanbeyan again (1869-72), the Illawarra (1872-4) and the Murrumbidgee (1875-6). During these years he was four times in office—as premier from 27 October 1859 to 8 March 1860 (he was defeated on a proposal to make the legislative council elective), as colonial secretary in the first Martin ministry (October 1863 to February 1865), as secretary for lands in the Robertson-Cowper ministry (October 1868 to April 1870), and as colonial treasurer in a later Robertson ministry (February 1875 to February 1876). On 4 February 1876 he was made agent-general, and lived in England until the end of 1879. Returning to Sydney a year later, he found he had been elected during his absence for Gundagai; this seat he held till his death on 30 October 1882.

Forster's political career, though continuous, was erratic, as is evident from his numerous migrations among the constituencies. He was not, in fact, a great parliamentarian; he lacked eloquence—which in the sixties was much valued—and was perhaps over-equipped with powers of caustic criticism such as makes sincere partisanship impossible and becomes occasionally awkward for one's own side. But both inside and outside parliament he was an influence for good, maintaining and enforcing on his friends a high standard both of political behaviour and of literary excellence, as it was in those days understood. His pungent criticism of insincere work, written or spoken, was in its day a valuable corrective of the extravagances of his would-be leaders. In the sphere of pure literature he did little; his only published works of this kind are *The Weirwolf, A Tragedy* and *The Brothers, A Drama*, written in New South Wales but published in London in 1876-7 while he was agent-general.

Fortesque, a small fish (*Centropogon australis*) rarely reaching a length of six inches, which is well known to fishermen on account of its power of inflicting painful wounds. On

each side of the snout grooved spines project backward; these are erectile, and are provided with glands secreting a venom which is used effectively by the fish if it be grasped incautiously, and causes an extremely irritating wound that not infrequently becomes inflamed. The fortesque is very common in New South Wales, and is often found in considerable numbers in prawn-nets which have been dragged over flats covered with sea-grass. Other closely allied species occur in Queensland, and the southern coasts of Australia and Tasmania are inhabited by the Soldier or Cobbler (*Gymnapistes marmoratus*) a species with the same armament as the fortesque. All these are strikingly marked with dark brown blotches upon a light ground, which doubtless serve as warning markings, the fishes being free to flaunt themselves in the presence of enemies by virtue of their venomous qualities.

A.R.McC.

Fossils. See PALAEONTOLOGY.

Foster, J. F. See FITZGERALD, J. F. V.

Foveaux, JOSEPH (1765-1846) was born in England in 1765. Nothing is known of his life until on 5 June 1789 he joined the New South Wales Corps (lieutenant, 1789; captain, 1792; major, 1796; lieutenant-colonel, 1802; major-general, 1814; lieutenant-general, 1830). In the corps he ranked as major as long as it was in New South Wales; his promotions of 1802 and later relate to army rank. His career in New South Wales from 1792 to 1801 was undistinguished, and his attention was devoted chiefly to farming his grants of land on Port Jackson and at Petersham and Toongabbie; in 1800 he had 31 cattle and 1200 sheep. In that year King, finding that Norfolk Island was being administered by captains of the corps changed every year, decided to station Foveaux on the island as a permanent lieutenant-governor, and the appointment was made out on 26 June, though the formal commission was not signed until 9 June 1801. Almost immediately after arrival he discovered and suppressed an incipient rebellion among the convicts, and was commended by the British authorities for his promptitude and vigour. He left the island on account of ill-health in 1803, and was soon afterwards relieved of the appointment, as the establishment there was to be much reduced. On 9 September 1804 he went to England on leave of absence, and while there drew up a plan for the evacuation of the island which the colonial office adopted.

On July 1808 he returned to Sydney, on his way to take up again the administration of the island with a view to its final evacuation. But he found that Bligh had at the beginning of that year been deposed by Johnston, and that an appeal had already been made to the British ministry. In these circumstances he decided not to reinstate Bligh, but to take over the government himself—being senior to Johnston—and carry on until news came from England. In so doing he managed to incur the hostility of both parties, for Bligh attacked him for his 'great intimacy' with Macarthur, while Macarthur called him 'that unprincipled man Mr. Foveaux.' Against these opinions may be set Macquarie's judgment that 'he could not with safety have adopted a different line of conduct from that he pursued.' Foveaux's assumption of the government was nominally terminated by the arrival from Tasmania of Paterson, who on 1 January 1809 took charge of affairs as lieutenant-governor; but Paterson was old and ill, and the practical work of administration was Foveaux's until Macquarie arrived at the end of the year. Macquarie at once approved of Foveaux's actions, praised his conduct of public affairs, and recommended him as a successor to Collins in the lieutenant-governorship of Tasmania. 'I have' he wrote, 'never yet met with any Officer . . . . that is more eminently qualified for forming and conducting to maturity and perfection any Infant Colony committed to his charge.' Foveaux's public works policy was undoubtedly praiseworthy: he found the Sydney streets almost impassable, the bridges dangerous and neglected, and the barracks, stores, and other public buildings much decayed, and in 18 months had greatly improved all roads and bridges and erected new buildings of sound quality, besides completely reforming the police force and reintroducing into the public service the virtues of industry, regularity, and economy.

On 17 March 1810 Foveaux sailed for England, to find on arrival there that he was liable to be tried by court martial for assenting to Bligh's deposition and imprisonment. On this account Macquarie's recommendation with regard to Tasmania was set aside; but in 1811 he was taken back into active service in the army and given a regiment of light infantry. His later career was undistinguished, and he died in London on 20 March 1846.

Fox Shark. See THRESHER SHARK.

Foxton, JUSTIN FOX GREENLAW (1849-1916), born near Melbourne on 24 September 1849 and educated at the Melbourne grammar school, was taken to Brisbane in 1864, trained for the law, and admitted a solicitor in 1871. In 1883 he entered parliament as member for Carnarvon, a seat which he retained until 1904. In May 1896 he was taken into the Nelson ministry as secretary for lands, retained that position in the Byrnes ministry (1898), became home secretary under Dickson (1898-9), and held that position under Philp (1899-1903), thus being continuously (except during the week-long Dawson ministry of 1899) in office for over seven years under four premiers. During this time he was responsible for much important legislation. As minister for lands he carried the crown lands act of 1897, which created a land court and a land appeal court, arranged for 21-year pastoral leases, and invented the 'prickly-pear' leasehold tenure. He had in the previous year carried a factories and shops act which severely limited child labour; but his chief achievement in this direction was his factories and shops act of 1900, the first really modern industrial legislation ever passed in Queensland. In 1887 he represented Queensland on the federal council. In 1906 he entered the federal parliament as member for Brisbane; in the 'fusion' ministry of 1909-10 he was honorary minister, and as such attended the important London conference of July 1909 which devised the 'unit' system of naval defence in Eastern waters. Defeated at the elections of 1910, he retired from politics, and died at Brisbane on 23 June 1916.

His hobby was soldiering. In 1869 he was commissioned lieutenant in the local field artillery, rose to be captain in 1884 and major (commanding the Brisbane field battery) in 1888, and after federation became commandant of the Queensland field force. (C.M.G., 1903.)

Francis, JAMES GOODALL (1819-1884), born in London and brought to Tasmania in

1834, entered commercial life as a clerk in the firm of Boys and Pointer, which in 1847 passed into his hands and those of a partner. In 1853, when Melbourne was growing rapidly on account of the gold discoveries, the firm opened a branch there and Francis became its manager; he soon established his position in the commercial world, becoming vice-president of the local chamber of commerce in 1856 and president in 1857. In October 1859 he was elected to the assembly by Richmond, and in November joined the Nicholson ministry as commissioner of public works; within a year, however, he left Nicholson and remained out of office until the advent of the McCulloch ministry (27 June 1863), in which he was commissioner of trade and customs. In McCulloch's third ministry (1870-1) he was treasurer. On 10 June 1872 he himself became premier of a coalition ministry that lasted just over two years, and carried against a good deal of denominational opposition an education act, based mainly on the report of Higinbotham's commission of 1866, which settled the colony's educational policy for more than 30 years. In 1874 a bill of his for settling disagreements between the two houses by joint sittings being coldly received, he retired from the ministry in favour of G. B. Kerferd. Returning to politics in 1878 as member for Warrnambool, he was honorary minister under James Service in 1880; but his failing health could not stand the strain, he abandoned politics in 1882, and died at Queenscliff on 25 January 1884.

Franklin, Sir John (1786-1837), born at Spilsby in Lincolnshire on 16 April 1786, and educated for the church, preferred a career in the navy, which he entered on 1 October 1800 (midshipman, 1800; lieutenant, 1808; commander, 1821; post-captain, 1822), joining H.M.S. *Polyphemus* and in her taking part in the battle of Copenhagen (1 April 1801). Immediately afterwards he was appointed to H.M.S. *Investigator*, which under command of his cousin, Matthew Flinders, was about to explore the coast of Australia. An account of this voyage is given under Exploration by Sea. Franklin followed Flinders into H.M.S. *Porpoise*, but after its wreck and the subsequent rescue accompanied Lieutenant Fowler to China in the *Eolia*; thence he took passage for England in the East India Company's ship *Earl Camden* under Sir Nathaniel Dance, who with a fleet of 16 merchantmen on 15 February 1804 defeated the French squadron under Admiral Linois, Franklin being Dance's signal-midshipman during the fight. Upon arrival in England he was appointed to H.M.S. *Bellerophon* and on 21 October 1805 was her signal-midshipman at Trafalgar. After a period of varied service he was present at the blockade of Flushing in 1814, and at the attack on New Orleans. In 1818 he commanded the brig *Trent* in Buchan's Arctic expedition (25 April to 22 October), and in 1819-22 commanded an expedition which traversed the northern latitudes of North America to determine its coast-line. On his return the Royal Society elected him a fellow and chose him to serve on its council. In 1825-7 he continued his survey of the North American coast; this expedition brought him a knighthood, the Oxford degree of D.C.L., and the gold medal of the Geographical Society of Paris.

In 1830-3 he commanded the *Rainbow* frigate, cruising usually on the coast of Greece; then, after a short rest, he was in 1836 appointed lieutenant-governor of Tasmania and reached Hobart on 6 January 1837, taking with him as private secretary Alexander Maconochie (q.v.). His appointment (warmly supported by William IV) was probably due (*a*) to the desire to reward his valuable services with a colonial governorship—a common practice at that time in military cases, all the governors of New South Wales from Brisbane to Fitzroy being officers of Wellington's armies—(*b*) to the desire to replace Arthur, a great but autocratic administrator, by a man more in consonance with the humanitarian and politically liberal ideas of the Grey-Durham-Buller school of politicians. Highly cultured, exceptionally humane, yet inured to naval discipline and a proved leader of men, he was exactly suited to his post; but the post was less well suited to him. He had looked forward to it as a period of easy and dignified repose after much toil; he found it a succession of struggles against the brutality of the convict system and the vested interests of Arthur's favourites and relatives. His own chief interests were the amelioration of the convicts' conditions of life, and the gradual improvement of social life in general by the better organization of education and adult studies. He enlisted the aid of Dr. Arnold of Rugby, who framed a scheme for a local college; the legislative council sanctioned the proposal, and the foundation stone was laid at New Norfolk, but the college was never built. For the advancement of science he established the Tasmanian Society, which in 1842-6-9 published three valuable volumes dealing with Australian science. But in the early forties the British control of colonial affairs passed from the hands of the Durham school into those of Lord Stanley, and humanitarianism was at a discount; Montagu, Arthur's nephew and Franklin's official secretary, whom he had dismissed for over-independence in dealings with matters that were the governor's prerogative, was backed by Stanley, and Franklin was recalled with a certain insolence. His successor, John Eardley-Wilmot, reached Hobart four days before Franklin was informed that he was to be recalled

Franklin's term of office ended on 21 August 1843, but he did not leave Hobart till November, visited New Zealand, and sailed from Port Phillip for England on 12 January 1844. Within nine months of his arrival he was again employed in Arctic exploration. The *Erebus* and *Terror* had just returned from the Antarctic, and it was decided to send them to discover the long-desired and apparently mythical North-west Passage. Franklin claimed the command, as the senior officer with Arctic experience, and on 18 May 1845 sailed for Greenland. On 26 July his ships were sighted off the entrance to Lancaster Sound. It was 14 years before anything definite was known of him or them. The expedition was provisioned for three years, and until that period was over no active steps were taken to relieve him; but between 1848 and 1857 no less than 38 relief expeditions were despatched from England or the United States, and, though only three found any traces of Franklin, and only the last (F. L. McClintock's in 1857-9) ascertained his fate, the results in opening up the Arctic regions were unsurpassed in the history of discovery. It seems that lack of provisions—great stacks of preserved-meat tins with putrid contents were found on Beechey Island—and exceptionally long and severe winters, that blocked with ice normally open sea-passages, proved fatal to the expedition; Franklin died on 11 June 1847, the ships were de-

sorted on 22 April 1848, and the refugees perished to a man in attempting to cross the frozen wildernesses of the Fish River estuary.

For the world at large Franklin's work was mainly connected with Arctic exploration. For Australians he is especially the man who tried to make convictism compatible with humanity; and his failure—or, rather the decision of the British government that he had failed—was the final proof that the two were incompatible, and to the essential factor in procuring the abolition of the system. (Kt. Bach., 1829; K.C.H., 1836.)

His second wife, JANE FRANKLIN (1792-1875), was married to him on 5 November 1828, and accompanied him both to Greece and to Tasmania. While there she travelled extensively on the Australian mainland as well as in the island, in 1839 crossing from Melbourne to Sydney via Yass and the Illawarra, in 1841 from Adelaide to the mouth of the Murray in Encounter Bay. She devoted herself particularly to the welfare of female convicts and of the poorer settlers' wives, and did her best to establish near Hobart a high school for girls. Montagu's attacks on Franklin were barbed with insinuation that Lady Franklin's too great influence over him disposed him to undue leniency, and certain local newspapers openly repeated the charge—which seems to have been wholly unfounded; her husband, at any rate, repudiated it with scorn. In 1841 she persuaded Gawler, then governor of South Australia, to provide at Port Lincoln a site for a monument to Matthew Flinders, and later in the year Franklin at his own expense erected a commemorative obelisk there. Lady Franklin is said to have initiated an attempt to make Tasmania a second Ireland by offering a shilling a head for snakes. For a time snakes' heads came in freely, and the payment was soon discontinued. Her later years were spent at first in fitting out expeditions to search for the *Erebus* and *Terror*, then in almost constant travel through and beyond Europe. She died in London on 18 July 1875.

Freemasonry. The first reference to Freemasonry in Australia is contained in a document dated 17 September 1802 which purports to admit Anthony Fenn Kemp 'into the grade of Ancient Masonry.' It is signed by Jacques St. Cricq, 'sovereign prince of Rose Croix,' George Bridges Bellasis, and Jerome Bellefin—Bellasis being artillery officer in the colony and the other two officers in the *Naturaliste*, a ship of Baudin's expedition. This document, however, concerns a continental form of masonry, and the first mention of British Freemasonry relates to the attempt, early in 1803, of Sir Henry Browne Hayes (q.v.)—in conjunction with officers of H.M.Ss. *Glatton* and *Buffalo* and several residents in Sydney—to establish a Masonic lodge and initiate new members. Governor King, however, prohibited the meeting and threatened Hayes with transportation to Norfolk Island. The meeting was nevertheless held early in May; but the police raided it, and Hayes was sentenced to deportation to Tasmania—though he somehow or other evaded this penalty. This meeting is regarded by Australian Freemasons rather as an interesting event than as a regularly-constituted Masonic gathering; no records of it are extant, and its objects are not known. One principle of the Craft is compliance with the law, and clandestine meetings are Masonically irregular.

In February 1814 the 46th regiment came to Sydney; its lodge had a regimental warrant from the Grand Lodge of Ireland, and was named 'The Lodge of Social and Military Virtues.' The lodge of the 48th regiment, which arrived in 1817, also held a warrant (No. 218) from the Grand Lodge of Ireland. The lodge of the 46th, on return to Great Britain, recommended the Irish Grand Lodge to grant a permanent charter to the Freemasons of the new country; this was done by warrant No. 260, naming the 'Australian Social Lodge' as the first colonial lodge. This lodge was established on 12 August 1820, which is the recognized date of the foundation of Freemasonry in Australia. The lodge has twice changed its name; it was first 'The Australian Social Mother Lodge,' but shortly after its centenary in 1920 assumed the name 'The Lodge of Antiquity.' The next lodge, formed by dispensation granted by lodge No. 260, was called 'Leinster Marine Lodge of Australia;' the dispensation was confirmed by warrant No. 266 from the Grand Lodge of Ireland, dated 12 February 1824. The first lodge under the English Constitution was the 'Lodge of Australia' No. 820, opened in 1838, which is now No. 3 on the register of the United Grand Lodge of New South Wales. The first Scottish lodge was 'Sydney St. Andrew' No. 358 (now No. 7). Then followed a quick succession of other lodges, which gave Freemasonry such a firm standing in the colony that the Grand Lodge of England was enabled to institute a Provincial Grand Lodge in 1839, followed by the Scottish in 1856, and by the Irish in 1858.

In the eighties there became manifest a marked desire for a properly constituted and duly recognized Grand Lodge of New South Wales. The position was acute, because 13 Irish lodges had in 1878 formed a so-called 'Grand Lodge of New South Wales,' which was never officially recognized by the Grand Lodges of Great Britain. When in 1885 Lord Carrington became governor of the colony, he was empowered by the Grand Master of England (the then Prince of Wales) to bring about a Masonic reconciliation; in this objective he was materially assisted by the arrival in 1888 of the Earl of Carnarvon, pro-Grand Master of England. After several conferences and an active canvass among the Lodges, a committee of five prominent brethren from each constitution was appointed to draw up a basis of union. 'The United Grand Lodge of New South Wales' was formally inaugurated in the Great Hall of the university of Sydney on 16 August 1888, under the auspices of the Grand Lodge of England, and fraternal recognition by all Grand Lodges of the world followed in due course. On 18 September Lord Carrington was installed as first Grand Master by Sir Samuel Way, Grand Master of South Australia, in the presence of 4000 Freemasons. The Grand Lodge thus started represented about 5600 brethren attached to 176 lodges.

In October 1923 the 500th lodge was dedicated under the name of 'Lodge Literature,' being composed of brethren connected with the press and with authorship. At that date the membership of the order in New South Wales was 52,000; its assets amounted to £213,000; and the probable value of Masonic real estate in New South Wales was at least £500,000. In the same year the William Thompson Masonic Schools for Orphans were opened.

Other Masonic activities under the United Grand Lodge of New South Wales are the Freemasons' Benevolent Institution—a society of voluntary subscribers, which arranges for

permanent pensions to the aged, the widows, and the permanently incapacitated—the New South Wales Masonic Club, and the Freemasons' Orphan Society. There is also a Freemasons' scholarship at the university of £50 per annum for three years for the sons of Freemasons of five years' membership.

Royal Arch Freemasonry was first practised in New South Wales by virtue of a warrent held by the Australian Social Mother Lodge. This warrant was returned to the Grand Lodge of Ireland in 1877, but the Lodge is still in possession of the original seal of the Chapter. There is evidence in the minute-book that the Royal Arch degree was conferred by this lodge as early as 4 June 1827; the Mark degree was conferred even earlier, on 8 November 1820. Leinster Marine (Irish) Chapter was established in 1848, Zetland (English) Chapter in 1855, and Burrangong (Scottish) Chapter in 1863. The Supreme Grand Chapter of New South Wales was established by the English Chapters in 1889.

The Mark Master Mason's degree is worked by Scottish and Irish Chapters, but not by the New South Wales Chapters, the latter leaving that degree to the Grand Mark Lodge of New South Wales, established in 1889.

Other branches of Freemasonry in New South Wales are the Ancient and Accepted Rite (33°) worked under the English and Scottish jurisdictions; the Knights Templar (English and Scottish systems) and the Knights of Constantine (Scottish). Appended to the New South Wales Mark system are the Royal Ark Mariners, and to the Scottish Royal Arch system the Ark and Red Cross and Cryptic degrees.

In *Tasmania* the first lodge—known as 'The Royal Fusileers' Lodge No. 33—was started by the 21st regiment, which held a charter from the Grand Lodge of Ireland, dated 1763. Another lodge was attached to the 51st regiment, and lodge meetings were held in the barracks at Hobart. From these in 1828 grew up a civilian lodge known as 'The Tasmanian' Lodge No. 31, under charter from the Grand Lodge of Ireland. Between 1828 and 1833 another civilian lodge was established, called 'Union' Lodge No. 326, and in 1834 was founded the 'Tasmanian Operative' Lodge (No. 345 under the Irish constitution). The removal of the 21st regiment caused the introduction of another civilian lodge, as the Master and senior warden of the regimental lodge settled in Tasmania and applied to the Grand Lodge of Ireland for a stationary warrant: this was granted in 1842, and the old title and number was allowed to be retained. On 26 October 1842 the first step for establishing a lodge in Launceston was taken when the lodge named 'St. John's' was established under a dispensation from the Tasmanian Operative Lodge. This new lodge received a warrant from the Grand Lodge of England and was No. 346, I. C., although it had previously applied to work under the military lodge No. 404, E. C. The lodge was opened on 19 January 1843, and in the same year the Masonic Benevolent Fund was started in Hobart. In 1844 at Hobart, the brethren of the Tasmanian Operative Lodge, mentioned above, applied for a warrant under the English constitution and called the lodge 'The Tasmanian Union;' it at first worked under dispensation from the Deputy Grand Provincial Master of Australasia at Sydney, and afterwards received a warrant bearing the number 781. This was the first introduction of English Freemasonry into Tasmania. On 7 September 1852 the 'Lodge of Hope' was erected. In 1855 the first Royal Arch Lodge was formed, and in November of that year three lodges obtained a Provincial Grand Lodge under the English constitution; but in 1860 this ceased to exist. During 1884 a petition from the various Irish lodges for a Provincial Grand Lodge was granted, and on 14 October the first Provincial Grand Master was installed. In 1885 the Scottish Masons made a move for a District Grand Lodge, and this was effected in August. In January 1888 all the lodges discussed the desirability of establishing a Tasmanian Grand Lodge; on 6 March 1890 decisive steps were taken, and on 26 June the Grand Lodge became an accomplished fact, with 22 lodges within its jurisdiction.

In *South Australia* Freemasonry dates from 22 October 1834, when the South Australian 'Lodge of Friendship' (No. 613 under the English constitution) was formally consecrated at No. 7 John-street, Adelphi, London; the Lodge was to meet monthly in the intended settlement of the colony of South Australia. A second meeting was held at the same place on 2 March 1835, but the next meeting was held on 11 August 1838 at the assembly rooms in Black's hotel in Franklin-street, Adelaide. In August 1841 Governor Grey of No. 83 Military Lodge became a member, and on 31 January 1844 E. Solomon offered the lodge a quarter of an acre of land for Masonic purposes and 10,000 bricks with which to build a lodge-room. In 1838 the lodge met at the Turf hotel in Weymouth-street, and in 1843 in Lambeth's auction room in Hindley-street. On 1 February 1844 the Adelaide St. John's Lodge was solemnly consecrated by the Lodge of Friendship; on 6 February the Lodge of Harmony was formed under a dispensation granted by the Lodge of Friendship under the English constitution, and on the 9th was duly consecrated. On 20 November the Lodge of Friendship memorialized the Grand Master of England for permission to form a provincial grand lodge in South Australia, and in January 1848 the Provincial Grand Lodge of South Australia was constituted—it was afterwards called the District Grand Lodge. On 16 October 1861 a Royal Arch Chapter was formed in connection with the Lodge of Harmony. In 1866, upon a memorial issued from South Australia, the powers of District Grand Lodges were greatly enlarged. Eventually the Grand Lodge of South Australia was established, on 16 and 17 April 1884 the charters of the lodges under the English, Irish, and Scottish constitutions were surrendered to this Grand Lodge, and on the 17th the inauguration ceremony was performed. Owing to a conflict of opinion whether the Grand Lodge was properly constituted, an independent charter was applied for and received from the Mother Grand Lodge of the United Kingdom. On 18 July 1889 Chief Justice Way resigned his Masonic office as Grand Master of the Grand Lodge of South Australia, and the United Grand Lodge was established. On 10 October the Earl of Kintore, then governor of the colony, was elected Grand Master, and on the 30th was installed by Lord Carrington, the Grand Master of the United Grand Lodge of New South Wales, assisted by Sir William John Clarke, Grand Master of the United Lodge of Victoria.

In *Victoria* on 23 December 1839 21 Freemasons petitioned the Grand Lodge of England to be recognized as 'Lodge of Australia Felix;'

the lodge was opened on 25 March 1840. The first lodge under the Scottish constitution was 'Australasian Kilwinning' No. 408, S. C. (now No. 2 V. C.). The first Irish Lodge was 'Australia Felix of Hiram' No. 349 (now No. 4 V. C.). The Scottish Provincial Grand Lodge was formed in 1847, the Irish Provincial Grand Lodge in 1854, and the English Provincial Grand Lodge in 1857. In 1882 Sir W. J. Clarke accepted the combined offices of Provincial Grand Master under the English, Scottish and Irish constitutions—a unique thing in Freemasonry. His object was, of course, an attempt at union, which did not immediately eventuate. In 1883 a Grand Lodge of Victoria was opened, but the Grand Lodges of the mother-country did not grant it recognition. In 1888, with the help of the Earl of Carnarvon, pro-Grand Master of England, a United Grand Lodge of Victoria was formed. All lodges in Victoria are under its jurisdiction, with the exception of Lodge Combermere No. 752, E. C. The United Grand Lodge has a Temple for administrative purposes and lodge meetings in Collins-street, Melbourne; the Victorian Masonic Club is at 64 Swanston-street; houses are provided for elderly brethren under the group system at South Yarra. Other Masonic systems in Victoria are the Grand Chapter of Royal Arch Masons, the Grand Mark Lodge, the Rosicrucian Order, English and Scottish Knights Templar and the Ancient Rite.

In *Queensland* Freemasonry was first established just after the separation of the colony from New South Wales, the 'North Australia' Lodge No. 1098 being founded in Brisbane under the English constitution in December 1859. The 'Prince of Wales' Lodge No. 1210, the 'Queensland' Lodge No. 1223 at Ipswich, and the 'Leichhardt' Lodge at Rockhampton, were founded shortly afterwards; the 'St. Patrick' Lodge No. 270 under the Grand Lodge of Ireland followed in 1863, and the 'St. Andrew' Lodge No. 435 under the Grand Lodge of Scotland in 1864. A District Grand Lodge under the English constitution was founded in 1862, and one under the Irish constitution in 1866: the latter included five lodges, a Mark Master lodge, and a Royal Arch chapter. A Provincial Grand Lodge established under the Scottish constitution in the same year had under it three lodges. In 1887 and 1897 efforts were unavailingly made to establish a sovereign Grand Lodge of Queensland, but on 20 August 1903 a deputation of Past Masters brought the matter before the Provincial Grand Master of the Irish constitution, and early in October a cable message from the Grand Lodge of Ireland intimated that it would approve of the proposed Grand Lodge for Queensland if it were 'regularly formed.' On 19 December it was resolved to form such a Grand Lodge, and after some friction—caused, apparently, by the irregular issue of circulars to lodges under the English constitution—a convention of delegates on 25 April 1904 declared the formation of the Grand Lodge of Queensland, with the constitution of New South Wales as a basis. On 7 September the Grand Lodge of England announced that it could not recognize the newly made Grand Lodge as having any jurisdiction in Queensland. However, after some correspondence the United Grand Lodge of New South Wales recognized the new body on 14 September, and on 29 October the installation of the Grand Master was performed by the Grand Master of New South Wales. The name of the new body was 'The Grand Lodge of Antient Free and Accepted Masons of Queensland,' and under it were 44 lodges, a board of general purposes, a board of benevolence, and a widows', orphans', and aged masons' institution. The District Grand Lodge under the English constitution governed 80 lodges and a district board of general purposes; there was also a District Grand Lodge of Mark Master Masons of England and Wales with about 20 Mark lodges. Under the Scottish constitution there were nearly 50 lodges in the southern jurisdiction and 20 in the northern. The District Grand Royal Arch Chapter of Queensland had fully 20 chapters in full working order.

In 1920 there was started a movement to bring about unity between the three constitutions, and as a beginning 85 lodges under the English constitution and 101 under the Scottish established the Queensland Grand Lodge. On 27 April 1921 the lodges under this Grand Lodge and the Grand Lodge of Queensland (281 in all) joined in forming the United Grand Lodge of Queensland, which has now (1924) 319 lodges on its roll. There are still three lodges holding under the Grand Lodge of England, and one under the Grand Lodge of Scotland.

Western Australia. It was not until 1842 that the first lodge was opened in this colony; this was the 'St. John' Lodge No. 712, working under the Grand Lodge of England. In 1845 another English lodge, the 'Unity,' was opened, but in 1879 the two lodges amalgamated under the first lodge's title, and this lodge is now No. 1 of the Western Australian constitution. Scottish Freemasonry was as active in opening lodges as was the English constitution. The District Grand Lodge (E.C.) was formed in 1877. The Grand Lodge of Ireland had but two lodges in Western Australia at that time. In the nineties, after many preliminary attempts, the founding of a Grand Lodge for Western Australia was seriously taken in hand, especially in view of a previous unauthorized attempt to form a Grand Lodge that would not have had even three lodges to govern. The leaders of the real movement to found a Grand Lodge were so successful in their operations that on 11 October 1899 the Grand Lodge of Western Australia was declared open; Sir Gerard Smith, then governor, was elected Grand Master, and was installed in February 1900, with jurisdiction over 33 lodges for a beginning.

The unwontedly close association, in the trenches and during most operations of the late war, of Australians who might otherwise have never come into contact with each other, resulted in a great accession of members to Freemasonry. In Australia, therefore, the Craft is both numerically strong and financially stable, with about 100,000 subscribing members and a capital (in real estate and reserve funds owned by the six Grand Lodges) of over £1,000,000. British Masonic law is closely followed, with occasional adaptation to Australian conditions, and the study of Masonic traditions, history, and evidences is carried on both by private students and in research lodges established for that purpose in each Australian metropolis. H.J.F.

Free Selection. See LAND LEGISLATION.

Fremantle. See PERTH.

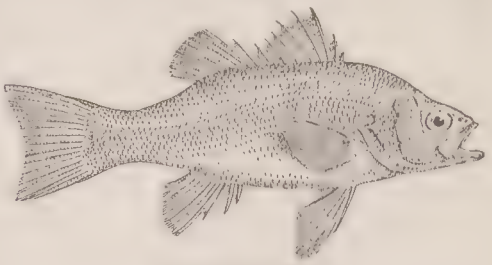
Fremantle, SIR CHARLES HOWE (1800-1869), born on 1 June 1800, was the second son of Admiral Sir T. F. Fremantle, a com-

panion of Nelson in most of his great exploits. He entered the navy in 1812 (lieutenant, 1819; commander, 1822; captain, 1826; rear-admiral, 1864), and saw active service as a midshipman at the blockade of New Orleans in 1814. In 1828, when in command of H.M.S. *Challenger*, he was ordered to proceed to the Swan River to take formal possession for the British crown of 'all that part of New Holland which is not included in the territory of New South Wales.' He arrived on 25 April 1829, and on 2 May hoisted the Union Jack on the south head of the river, where Fremantle now stands. Captain Stirling and other officials, together with the first band of settlers, reached Swan River on 1 June, and the *Challenger* left Swan River on 28 August for India. Fremantle served with distinction during the Crimean war, became commander-in-chief at Devonport, and died in 1869. (K.C.B., 1857; G.C.B., 1867.)

French, Sir George Arthur, born at Roscommon in Ireland on 19 June 1841 and educated at the royal military college, Sandhurst, and the royal military academy, Woolwich, joined the royal artillery in 1860, went to Canada as adjutant R.A. in 1862, was commissioner of the north-west mounted police from 1873 to 1876, and in that capacity took part in the Red River expedition of 1874. After a period of service (1878-83) at Devonport, he was in 1883 made commandant of the Queensland military forces, retiring in 1891 with a reputation that brought him in 1896 the command of the military forces of New South Wales. His strenuous and successful training of these troops was largely responsible for the value attached to the services of New South Wales contingents in the South African War. He retired from the army in 1902, and has since lived privately in England. (C.M.G., 1877; K.C.M.G., 1902.)

French, Sir John Russell (1847-1921), born in India in 1847, was brought by his parents to New South Wales in 1858. His father settled at Kameruka on the south coast, but died almost at once, and the boy in 1863 entered the service of the Bank of New South Wales; he passed through all grades of service, becoming an inspector in 1872, chief inspector in 1891, and general manager in 1894. Taught by the banking crisis of 1893 (which had been handled by his immediate predecessor, but with the advantage of his cool advice), he at once joined T. A. Dibbs (see Dibbs, Sir G. R.) in a campaign to obtain uniform banking legislation throughout Australia. Holding aloof from politics as such, he became the adviser of State and Federal treasurers, and made his bank the most influential in Australia, always insisting that steady rates of interest were best for business, and more advantageous for the banks than the occasional high profits obtainable when rates fluctuated. During the war his help was invaluable to ministries in search of a sound financial policy, as well as to charitable institutions and to the administators of various funds that were established for war-purposes; and almost his last moments were spent in devising remedies for the tangled exchange situation of 1920-1. He died at Sydney on 30 June 1921. (K.B.E., 1918.)

Freshwater Perch (*Percalates colonorum*), inhabits the coastal streams of south-eastern Australia between Moreton Bay and Spencer Gulf, and also occurs in Tasmania. Though a freshwater fish, it often descends to saltwater estuaries, where it is largely captured by net-fishermen and is known as 'estuary perch.' It is very variable in form, a fact



Freshwater Perch.

which has led to its subdivision by some writers into several species. It provides excellent sport for rod-fishermen, and occasionally attains a length of 20 inches. A.R.McC.

Freycinet, Louis de. See Exploration, French.

Friar-birds, perching birds belonging to the genera *Tropidorhynchus*, *Philemon*, and *Entomyza*, members of the family of honey-eaters (Meliphagidae), q.v. The two former genera occur in eastern and northern Australia, New Guinea, and the Papuan islands; the last is confined to eastern and northern Australia.

Leatherhead.

These birds, which are among the largest members of the honey-eater family, are characterized by moderately long, curved bills and the absence of feathers from part or the whole of the head; hence some of them are often called leatherheads.

The common Friar-bird or Leatherhead (*Tro-*

pidorhynchus corniculatus) of eastern Australia has the whole of the head and neck bare, the naked skin being black. A small hump or protuberance rises from the base of the upper mandible of the beak. In the Helmeted Friar-bird (*T. buceroides*), of northern Queensland and the Northern Territory, the hump is very much larger, as implied by its name. The Silver-crowned Friar-bird (*T. argenticeps*) of northern Australia has some silvery feathers on the top of the otherwise naked head. The Yellow-throated Friar-bird or Little Leatherhead (*Philemon citreogularis*), of northern and eastern Australia, has no hump on the bill; only the sides of the head are bare, the naked skin being dark bluish-grey. The frier-birds are dull-coloured, brown above and whitish below, with pointed, silvery-white feathers on the breast. They are very noisy, and utter most curious chuckling notes and gurgling sounds, that give the effect of carrying on a conversation.

The two species of *Entomyza* are nearly related to the friar-birds, but differ decidedly in colour, being rich yellowish-green above and white beneath, with black patches on the head and breast. The sides of the head are naked, and the skin a rich greenish-blue. The Blue-faced Honey-eater (*E. cyanotis*) is fairly common in south-eastern Australia; the White-quilled Honey-eater (*E. albipennis*) occurs in northern Queensland and the Northern Territory.

W.B.A.

Friends, Society of. This religious body, which had its rise in England about 1650, and is closely associated with the name of its first leader, George Fox, has been represented in Australia from early days. For a time, owing to its small and widely scattered membership, it lacked organization; and its history illustrates the difficulty that besets all small communions in maintaining their individuality. Where but few members live within easy reach of one another, the question often arises whether in their own best interests—and especially in the interests of their children—it is more desirable to keep up a limited separate congregational life, or to unite with neighbouring churches. Where the latter course is chosen, the energies of the individual become merged in those of the gathering with which he has associated himself, and whatever was distinctive in his earlier belief may be gradually lost.

As an organized body, 'Friends' in Australia date from the missionary labours of James Backhouse (q.v.) who in 1831 came to Australia under a strong sense of duty, officially accredited by the Society of Friends in England. His credentials were wide in their scope; 'to visit in the love of the Gospel the inhabitants of the British Colonies and Settlements in New Holland, Van Diemen's Land and South Africa.' He also brought introductions to officials in authority, for he was a well-known and many-sided man of science, apart from his special call to religious service. Arriving in Hobart early in 1832, Backhouse drew together the few Friends he could find, and united them to form a regular congregation. This as time went on grew in numbers and branched out, other meetings being formed up and down the country. Backhouse laboured throughout Australia for six years. Before he returned to England in 1837, Sydney and Melbourne had established Meetings, and about the same time a similar advance was made in Adelaide and Brisbane, which became in due course centres for other congregations. Thenceforward, with some fluctuations, the progress of the Society of Friends has been steady, if slow. They are still a small body, but not without influence; and the drawing together of the different States, politically and through the development of facilities of intercourse, has helped Friends greatly and increased their solidarity. Their adherents in full membership do not exceed 1000 in the Commonwealth of Australia, but they are represented from time to time in the legislatures and other responsible public bodies.

Church government has as its basis the Monthly Meetings in Tasmania (held in Hobart), Victoria (Melbourne), New South Wales (Sydney), the Two Months' Meeting of South Australia (held alternately at Adelaide and Eden Hills), and the corresponding Meeting for Queensland (held in rotation at Brisbane, Toowoomba, and Rockhampton). Representatives from these constitute the General Meeting held annually at Sydney, Melbourne, Hobart, and Adelaide in succession, which is the authorized mouthpiece of the Society throughout Australia. It is, however, itself a constituent part of the London Yearly Meeting, the recognized synod and focus for all English Friends.

About 35 years ago a Friends' high school was established in Hobart, to subserve the needs of all the mainland States; pupils have been sent to it from Torres Straits in the north, Perth in the west, and New Zealand in the east, and its roll of pupils is now (1925) about 250. It accepts all who desire a guarded education under Quaker influence, but may in other respects be considered unsectarian.

It would not be appropriate here to enter into questions of doctrinal belief, or to dwell on what Friends have stood for, as citizens, in the national life. Their record is public property. During the recent war some members came into public notice as 'conscientious objectors,' refusing military training and service, and suffering imprisonment for so doing both in Australia and New Zealand. But though they refused to bear arms, the Quaker young men of Australia gave themselves freely for non-combatant service at the front in ambulance corps and similar work, as voluntary workers, accepting no remuneration. The Friends' War Victims Relief Committee, too, from its central London offices sent young men and women out in hundreds to render help of every kind wherever the need was greatest. Amongst these were young Friends from Australia and New Zealand, who took leading positions in the organized relief of the refugees who swarmed into Holland; in the war-wasted provinces of France (where the government entrusted a large district to their care to be rehabilitated); in Austria and Poland and the wastes of Russia, and even in Serbia. After the armistice their efforts were largely concentrated upon famine relief. In Russia they were for a time the only organization allowed any facilities by the Soviet government, and their work was on a large scale.

W.B.

Frigate-birds, large marine birds, mostly inhabiting tropical seas, which belong to the family Fregatidae. Sailors know them also as man-o'-war birds. Two species occur in Australian seas, chiefly within the tropics; but only the Lesser Frigate-bird (*Fregata ariel*) is known to breed on the Australian coast. Colonies of it are known on Raine Island in northern Queens-

land, and on Bedout and Adele Islands in north-western Australia. W.B.A.

Fringed Violet. See THYSANOTUS.

Frodsham, GEORGE HORSFALL, born at Sale Moor in Cheshire on 14 September 1863, and educated at University College, Durham (B.A., 1888; M.A., 1895; D.D., 1903), was ordained deacon in 1888 and priest in 1889, and up to 1896 worked at Ilkley in Yorkshire. In 1896 he was made rector of St. Thomas's church in Brisbane and chaplain to the bishop of Brisbane, and in 1902 was consecrated bishop of North Queensland (a diocese larger than the British Isles); he resigned this see in 1913 because the tropical climate was found unhealthy for him. Returning to England, he was in 1914 made canon residentiary of Gloucester, in 1920 became vicar of Halifax in Yorkshire, in 1921 was made rural dean of Halifax, and in 1923 canon of Wakefield.

Bishop Frodsham's activities extended far beyond the religious sphere. While in Queensland he took an active part in the foundation of the Australian institute of tropical medicine and in all movements designed to benefit the aborigines, improve secular education, or further social welfare. He was chaplain in the military forces from 1899 to 1910, during the war helped to formulate the A.I.F. education scheme, and in 1922 became senior chaplain in the Northern Command of the British army.

Frogmouths and Nightjars, soft-plumaged, nocturnal birds with long wings, small feet, and very broad bills surrounded by bristles, which feed on night-flying insects. The Frogmouths (Podargidae) are comparatively large birds, peculiar to southern Asia, the Malay Archipelago, and Australia, which build nests of sticks on the branches of trees and lay white eggs. Four species occur in Australia; three are rare birds confined to the tropical scrubs of the north-east; the other, the Tawny Frogmouth (*Podargus strigoides*), is common throughout the continent and Tasmania. This bird is often known as the mopoke, from the belief that it is responsible for the cuckoo-like call, so familiar at night in the bush, which is in reality uttered by the boobook owl (see OWLS). The ordinary call of the frogmouth is a series of deep double notes, sounding like 'oo-oom' constantly repeated. Rarely, however, it does utter a note not very dissimilar from that of the boobook owl. During the daytime it rests on the branch of a tree, sitting lengthwise and not across the bough like most birds. Its mottled plumage and curious, stiff attitude give such a resemblance to a broken-off limb of the tree that it is often difficult to believe it really a bird.

Mopoke.

The Owlet-nightjar (*Aegotheles cristata*), found throughout Australia and Tasmania, is the only species in the family Aegothelidae. These small birds lay white eggs in a hole in a tree, and during the daytime live in holes, uttering a hissing sound when disturbed.

The nightjars (Caprimulgidae), found throughout the world, are represented in Australia by three species, none common. They lay beautifully marbled eggs on the bare ground; by day they usually rest on the ground, hawking for insects at twilight and in the early morning. W.B.A.

Frogs. See AMPHIBIA.

Frost-fish (*Lepidopus caudatus*), a widely distributed species of the family Trichiuridae, occurring in deep water in various parts of the Atlantic, Indian, and South Pacific Oceans. It sometimes appears in considerable numbers along the coasts of New Zealand, and is cast up on ocean beaches during cold, frosty weather. Some writers have affirmed that the fish approaches the shore for the purpose of depositing its spawn in the winter months, but no proof of this is available; it is probable that the fish is forced by abnormal conditions up from the depths that are its natural environment, is rendered helpless by the sudden lowering of outside pressure, and is caught in the waves and cast ashore. This suggestion is supported by the fact that specimens have been observed wriggling helplessly in the water before being stranded, and have even fallen victims to sea-birds which pecked out their eyes, etc., while the fish were swimming aimlessly in the surf.

The frost-fish is long (up to six feet) and ribbon-shaped, with a large mouth and strong teeth; the skin is like burnished silver, and the flesh is excellent eating. In English waters it is known as the 'scabbard-fish.' Barracouta (q.v.) and hair-tails belong to the same family. A.R.McC.

Fruit-growing. Australia possesses few indigenous edible fruits. Except the geebung (q.v.) and the five-corners (q.v.), which are still occasionally sought for in the bush, none are valued by the present white population. In November 1790, however, Governor Phillip reported

that of the native fruits then in season the settlers found two very agreeable to the taste—an acid berry about the size of a currant, which the surgeon considered an excellent antiscorbutic, and which, with a large proportion of sugar added, made excellent tarts and jellies; and a red fruit, also about the size of a currant, which the settlers ate in great quantities. But no attempt was made to cultivate these, and the history of fruit-growing in Australia is a record of the acclimatization of introduced fruits. On his voyage out Phillip secured at Rio de Janeiro seeds and plants which were planted near the present site of the obelisk in Macquarie Place. There is not sufficient evidence to support the story that Richard Johnson (q.v.) planted an orangery at Kissing Point in 1788; but orange plants were included in Phillip's cargo, and some were sent to Norfolk Island when it was occupied in 1788. Orange-culture was very successful in the island during its first occupation; but, when it was reopened as a penal settlement in 1826, the new commandant ordered the trees to be destroyed, as the fruit served as food for runaway convicts. In 1789 Sir Joseph Banks erected a plant-cabin in the *Guardian*, and stocked it with fruit and other plants likely to be useful in the new settlement, but the vessel was lost at sea. In 1794 Banks suggested that a similar cabin should be erected in the *Reliance*, but this plan was not adopted, and the proposed consignment was not despatched until 1800, when one olive, six apples, six black and six white mulberries, 18 Chilé strawberries, two walnuts, two Spanish chestnuts, four pomegranates and several varieties of vine (see VITICULTURE) reached the colony alive, but not all survived transplantation. In 1801 Flinders reported that a plant-cabin was being fitted up in the *Investigator* to take useful plants to Sydney. Caley in 1803 reported that water-melons were much appreciated and apples and figs were growing well, but the fruit that had succeeded beyond expectation was the peach; peach-cider, he thought, would become a good beverage in a few years. In 1806 the governor offered a prize for the best cider prepared during the next peach season, but Surgeon Luttrell wrote in 1807 that attempts to make the cider had been unsuccessful. The principal fruits growing at that time were peaches, apricots, pears, apples, quinces, mulberries, strawberries, raspberries, nectarines (introduced by Bligh), loquats, plums (of indifferent quality), filberts, walnuts, pistachio nuts, and a few olives, oranges, and lemons. Cherries had not yet reached the colony. The excellence of the early varieties of peach (most of which have since died out) and the ease with which they could be grown induced Allan Cunningham (q.v.) to plant peach-stones on his exploratory trips inland, in the hope that they might thrive without further attention and so compensate for the lack of indigenous fruits. A less favourable account of the colonial fruits than those already quoted was given by Pierre Lesson, naval surgeon and corresponding member of the Institut de France, who visited Sydney with Duperrey in the *Coquille* in 1824: '. . . . apples and pears are only middling; the grapes are juicy, but the peaches detestable; oranges good enough, as are figs, strawberries and gooseberries. The governor sent our captain pineapples, quite ripe and as delicate in flavour as those of Tahiti.' Most of the fruit was now being grown at Ryde and in the neighbouring districts along the Parramatta River, which were proving specially suited for citrus fruits.

Until the eighties of last century the distribution of different fruits was determined by natural conditions. By that time Queensland was growing bananas (q.v.) and pineapples in the south-east, and more extensively along the warm coastal belt as settlement moved northwards. The mango, passion-fruit, granadilla, paw-paw, guava, orange, apple, peach, and plum were also grown in suitable localities. In New South Wales the chief producing area was the county of Cumberland and its neighbourhood as far as the Kurrajong on the west and Gosford on the north. In this area citrus fruits predominated. Tropical fruits were cultivated in the north coast district; cherries throve in the volcanic soil round Orange and in the colder areas of the tablelands. Apples, pears, peaches, plums, apricots, and melons were widely distributed. Loquats were frequently grown as a breakwind, as well as for the fruit. In Victoria the apple, plum, peach, apricot, cherry, and pear were the principal varieties grown; raspberries, gooseberries, and currants were also cultivated in the cool, elevated districts. In Tasmania most of the area devoted to fruit-growing was given up to apples; currants, raspberries, and gooseberries were widely distributed, and pears, plums, cherries, apricots, and peaches were also grown. In South Australia the apple, pear, cherry, prune, and berry fruits grew well in the high lands round Mount Lofty and Barossa, in the ranges behind Port Pirie, and in the south-east; citrus and stone fruits were distributed through the low hill country and the plains. The almond and the olive had also been successfully introduced into South Australia. Olives had been sent to Sydney as early as 1800 by Sir Joseph Banks, and may have been introduced into South Australia, together with the vine, from that source. No considerable effort was made to cultivate them, however, until 1844, when truncheons from Marseilles were imported by the South Australian Company. Oil from the berries was sent to the international exhibition of 1851, where it obtained honourable mention for its clearness, colour, and flavour. The calcareous nature of the soil round Adelaide and the warm dry climate well suited the growth of olives, but the industry was hampered by the length of time required before the trees became productive. In 1878 the government of South Australia, to encourage olive-cultivation, published a pamphlet prepared by W. R. Boothby after a tour through the olive-growing districts of Europe. Special attention was given to the industry by Sir S. Davenport. In Western Australia the apple, orange, peach, pear, plum, fig, and apricot were chiefly grown. It is evident that by the eighties practically all known fruits were being grown within the wide range of Australian climatic conditions from the pineapple, paw-paw, mango, and guava of the tropics to the strawberry, raspberry, and currant of colder climes.

But the industry was limited by the small local demand of Australia. There was some intercolonial trade, but this was confined, generally speaking, to a small export of pineapples and bananas from Queensland southward, a considerable export of citrus fruits from New South Wales to Victoria and Tasmania, and a return movement of apples, pears, cherries, plums, and gooseberries. The first impetus to expansion, other than the slow natural development to meet increasing local demands, was the opening up of the apple and pear trade (see APPLES AND PEARS) by Tasmania—and to a less extent by Victoria and New South Wales—with Great Britain at the end of the eighties. When the county of

Cumberland in New South Wales was the only important citrus area in Australia, attempts were made to open up an overseas trade, the first consignment being a cask of oranges and lemons sent successfully to Dublin in 1880. But the risks of transport were still too great for the venture to be worth while on a large commercial scale, and though several shipments were subsequently made no considerable effort was made to place oranges on the English market until 1923. Irrigation settlements, devoted primarily to viticulture and the fruit industry, have been developed since the eighties along the Murray valley and in areas watered by the Goulburn in Victoria and the Murrumbidgee in New South Wales, and by private irrigation schemes in the south-west of Western Australia. To find an outlet for the fruit products of these districts attempts are being made to open up new home and overseas markets for fresh citrus and canned and dried fruits, on the demand for which the future of the settlements largely depends. The irrigated districts are producing good citrus fruits; the Washington navel orange has been specially cultivated along the Murray and Murrumbidgee; choice oranges are also grown by artesian irrigation at the Pera bore near Bourke. The overseas orange trade seems now to be firmly established; Australian growers are specially fortunate in this regard, since their oranges shipped in July-September can be placed on an empty market in Great Britain. In addition to the citrus industry, the settlers are giving much attention to the canning and drying of fruits. In the Murrumbidgee area, whose climate is not so suited to fruit-drying as that of the Murray valley, stone fruits are grown for canning and jams. During the war a special impetus was given to jam-making by the placing of large allied orders in Australia for military purposes. The dried fruit industry was started on a small scale during the seventies and eighties. Tasmania was drying apples; Queensland was endeavouring to place small consignments of dried bananas on the English market, and was making experiments in drying mangoes; in other colonies similar experiments were being made with suitable fruits. But it was not until the settlement of the Murray valley and the south-west district of Western Australia that the industry developed to commercial proportions. Raisins, sultanas, and Zante currants are chiefly treated, but apricots, peaches, nectarines, figs, pears, and prunes are not neglected. Some attention has been given recently to the drying of persimmons. The rapid progress of the industry is generally attributed to the practical monopoly secured to it within the Commonwealth by the imposition of a tariff on all imported dried fruits which can be produced locally, and to its organization for marketing purposes by the formation of the Australian Dried Fruits Association in 1907. This association has been trying since the war to stimulate overseas demands, and has especially urged the adoption by the British government of a scheme of imperial preference which will give Australian growers a competitive advantage over Mediterranean products.

With the development of the fruit industry has arisen a need for its better organization. The new impetus noticeable towards the end of the eighties was supported by horticultural societies in the various colonies and stimulated by newly established departments of agriculture. Fruit-growers' organizations of a loose and changing character were formed, and intercolonial conferences were and are held annually. In 1922 the Commonwealth government called a conference of representatives of the fruit industry, at which it was agreed that a federal fruit council, with an advisory board in each State, should be formed to advise the governments of the Commonwealth and the States on all matters relating to the industry. In 1925 a Fruit-growers' Federation at its annual conference eulogized the work already done by these boards.

In 1922-3 the area devoted to fruit-growing in Australia totalled 275,687 acres of which 73,145 acres were in New South Wales, 86,014 in Victoria, 29,431 in Queensland, 33,003 in South Australia, 19,405 in Western Australia, and 34,689 in Tasmania.

The yield of the more important fruits in the different States was:—

Fruit.	New South Wales.	Victoria.	Queensland	South Australia.	Western Australia.	Tasmania.
Apples (bushels)	723,522	2,089,017	115,928	384,375	758,998	3,127,509
Apricots (bushels)	163,382	290,876	2,948	268,152	40,224	112,823
Bananas (bushels)	350,289	.....	1,618,848	.....	488	.....
Lemons (bushels)	231,396	109,347	24,012	53,483	45,713	.....
Nectarines and peaches (bushels)....	709,267	981,701	90,472	231,926	71,447	5,709
Oranges (bushels)	1,743,938	259,330	282,174	411,508	201,809	.....
Pineapples (dozen)	4,863	.....	895,372	.....	.....	.....
Pears (bushels)	203,344	666,631	8,822	125 353	106,827	204,297
Plums (bushels)	242,804	258,117	33,743	123,211	61,406	58,765

The net export of fresh fruits in 1922-3 totalled 106,001,300 lb. valued at £1,012,207; this represented a marked increase since 1918-19 when only 7,152,600 lb. were exported valued at £98,347. The expansion is due partly to an extension of overseas markets and partly to the rapid decline in imports, chiefly of bananas, owing to the imposition of a protective tariff. The net export of dried fruits in 1922-3 was 25,090,263 lb. valued at £1,042,727; of jams and jellies it was 2,453,982 lb. valued at £71,143—a very marked decrease since 1918-19, when military orders were still being placed in Australia. The returns for the net export of canned fruits are not differentiated from those of vegetables, the value of the two being £51,582 in 1922-3.

Fulton, HENRY (1761-1840), an Irish Protestant clergyman, in 1797 held a benefice in

the diocese of Killaloe, but took some part in the rebellion of 1798, and according to the bishop of Derry confessed his guilt under pressure and 'agreed to transport himself for life to Botany Bay.' This was not uncommon at the time; there was grave laxity in securing legal authority to transport captured rebels (see IRISH EXILES), and many of them were merely court-martialled, sentenced to death, and amnestied on condition of leaving Ireland for good. Fulton —who is described by his bishop as a very well-informed man and peculiarly zealous in the discharge of his duties—reached Sydney in the convict transport *Minerva* on 11 January 1800, and caused Hunter some trouble ('we can scarsely divest ourselves' wrote the governor, 'of the common feelings of humanity so far as to send . . . . a Protestant clergyman and family to the grubbing hoe or timber carriage'); on 8 November he was granted a conditional pardon, and on the 20th sent to the Hawkesbury to act as chaplain. In February 1801 he was transferred to Norfolk Island, and for seven years carried out the duties of chaplain there so conscientiously that King recommended him to receive full pay, and in 1805 granted him a full pardon. In 1806 he returned to New South Wales to take over the senior chaplaincy from Samuel Marsden, who was proceeding to England on leave. Bligh took him into favour and made him a member of the civil court. When Bligh was deposed, Fulton openly protested, and was at once suspended by Johnston from his chaplaincy, but was reinstated by Macquarie on 7 January 1810. Later in 1810 he went to England to give evidence for Bligh, and on 31 May 1811 had his position as chaplain regularized (for it had not previously been confirmed in England) by a formal appointment as assistant chaplain to the colony. Returning in 1812, he acted for some months as locum tenens for William Cowper, then head chaplain, and in 1814 was given a charge of his own at Castlereagh on the Hawkesbury and made a magistrate of the colony. By 1818 he had established there a school for the children of well-to-do parents, at which a sound classical education was obtainable; among his pupils was Charles Tompson the first Australian-born poet (see LITERATURE). About 1825, however, the increasing pressure of parish work forced him to close the school. Macquarie had a high opinion of him and, when compelled by orders from England to reduce his stipend (mainly because chaplains of higher standing were being sent out), compensated him with a grant of 600 acres a little north of Mulgoa. In 1828 he launched out as editor of a magazine, *The Blossom*, but it died after the first issue. During the thirties the centre of gravity of his parish shifted from Castlereagh to Penrith, and in 1838 the parish church was erected there. Fulton must have welcomed this as the crown of his labours, and worked there till his death on 16 November 1840. W.J.

Fungi. Under this name some naturalists have included lichens and Mycetozoa (Myxomycetes) but the latter are now considered a class by themselves, and the former are known to be of dual individuality—fungi living on algae; both are therefore in this treatise dealt with under their own names, and only the true fungi are considered here. The larger forms have been well investigated, but many of the smaller kinds have not yet been carefully studied. Some 70,000 species (in 105 families) have been recorded, about 2000 of them being known to occur in Australia. The most familiar are the mushrooms (Agaricaceae) and the touchwoods (Polyporaceae); the common Edible Mushroom (*Psalliota campestris*) has a world-wide range in the temperate zones, and of the Polyporaceae several produce dry rot. Familiar, too, are the vine-mildew (*Oidium*), which belongs to the Perisporiaceae, and the rusts, smuts, and bunts that destroy cereal crops, all Basidiomycetes. While the naked eye can readily distinguish between common species like *Fomes robusta* and *Trametes lactinea*, a microscope is needed to study the internal structure and life-history of any fungus. The methods of fructification are inconceivably various, and families differ amongst themselves as much as any fungus differs from a flowering plant.

The study of the fungi from the pathological and economic points of view is of extreme importance. Plant and animal life are alike widely subject to diseases originating from microscopic parasitic fungi, whose methods of reproduction must be known before any counter-attack can be organized. Such are the Flag-smut (*Urocystis tritici*), the Spring and Summer Rusts (*Puccinia triticina* and *P. graminis*), the Bunt (*Tilletia caries*) and Take-all (*Ophiobolus graminis*), so costly to the wheat-farmer. The Irish Blight (*Phytophthora infestans*) has already, since its first appearance in Australia in 1909, destroyed potato crops over wide areas.

The most serious fungous pest in our orchards is the Black Spot, or Apple Scab (*Fusicladium dendriticum*), and its ally *F. pyrinum*—sometimes known as the Windsor pear blight—which cause the splitting of the fruit, and prevent their uniform growth. A species of *Sclerotinia* attacks beans; *Stereum purpureum* causes the silver-leaf disease in fruit-trees. Peach-leaf curl is caused by the fungus *Exoascus deformans*, so prevalent in cold, wet weather. The shot-hole disease of the apricot is fungous; young apple-trees and nursery stocks are subject to a disease known as powdery mildew or fire-blight, caused by the fungus *Podosphaera Kunzei*. Dead spots and holes in strawberry leaves are due to *Sphaerella fragrariae*. A more insidious foe is the grape-vine disease 'pourridie,' which also attacks other fruit-trees, especially in badly drained land. Appearing as dry rot, it is due to the minute hyphae of a fungus whose fruit may be seen as brackets growing from the bark, or as toad-stools near the roots. *Armillaria mellea*, an edible mushroom, is said to be one of the fungi that produce this disease. The remedy for most fungus-caused diseases is spraying with Bordeaux mixture; but good drainage and a sufficiency of lime in the soil are probable preventatives. Bunt has been most successfully treated in New South Wales with dry copper carbonate, and formalin is largely used as a fungicide in America.

Many human diseases like ringworm and thrush are regarded as fungoid, and fish kept in aquaria or ponds are attacked by a parasitic fungus, *Saprolegnia ferax*. The insect world is affected by the silkworm disease, the bee-fungus and the curious growth known as the Vegetable Caterpillar (*Cordyceps*), of which three species are recorded from Australia and two from New Zealand; a smaller species (*C. gracilis*) appears to be cosmopolitan. Some 160 species have been named, and many wild fictions have been related concerning them. The mycelium of the fungus permeates the tissue of the caterpillar or pupa while underground; arriving at maturity, it sends out fleshy, club-like stems which project several

inches from the ground.

Horse-hair fungus is a sterile mycelium of *Marasmius equicrinis,* that overruns with a blackish, thread-like growth the branches and trunks of trees in the dense scrubs of eastern Australia, the Pacific islands, and India. It has often been mistaken for a lichen. *M. rotula, M. sarmentosus* and *M. obscuratus* are allied species.

Mycorhizal fungi—tuft-like masses of hyphae which infest certain roots—appear to be in some cases actually necessary to the plant, performing the function of root-hairs. This growth is remarkably similar to the hairy-root disease of the apple-tree, which causes stunted root-growth, with excessive production of fibrous roots. These mycorhizal fungi are frequent in peat-loving plants, or in alkali soils that are poor in nitrates; they probably supply atmospheric nitrogen to the plants. They are especially found in Ericaceae, Epacridaceae, Proteaceae, and Coniferae, which inhabit acid situations. Analogous instances of fungal symbiosis with roots are the association of *Boletus granulatus* with *Pinus radiata* (*insignis*) and *P. pinea* and that of *Scleroderma verrucosum* with species of *Quercus.* M. Bernard has shown the co-operation of fungi in the germination of certain orchids, and *Phoma* has been suggested as necessary for the germination of certain heaths (*Erica*). The want of success in germinating seeds of our *Epacris* under artificial conditions suggests a similar economy in the case of *Phoma,* sometimes found on decaying eucalypt leaves.

Near decaying stumps or roots of eucalypts rounded lumps varying in size from a pin's head to a human head, and known to most people as 'blackfellows' bread,' are often found. These are the sclerotia of *Polyporus mylittae,* composed of compacted mycelial strands of remarkable vitality, and are really stores of reserve material intended to provide against the strain of fructification. Another member of the same family (*P. eucalyptorum*) produces the felt-like fungus found on many eucalypts, which resembles the European touchwood; the latter is of commercial importance as a constituent of warm underclothing, and for mixing with saltpetre to form amadou (German tinder).

Fungi surpass all other vegetable products in the richness of their proteids. The following percentages of nitrogen in various dried fungi indicate their nutritive value: *Cantharellus,* 3.22; *Boletus,* 4.7; *Russula,* 4.27; *Lactarius,* 4.68; *Psalliota,* 7.26; morel, 8.23; truffle, 15.35. In comparison with other vegetable foods the percentages of proteids are as follows:—truffle, 35; morel, 36.25; mushroom, 26.31; lentil, 29.33; peas, 28.02; wheat, 16; rye, 12; potato, 1.5. Even the poisonous fungi contain much nutritious food, and would be valuable if their poisonous principles could be eliminated. Some of these principles are volatile, and can be dispersed by high cooking; others are rendered innocuous by the application of vinegar and salt. A considerable number of edible fungi have been tested in Europe where—especially in France and Italy—they are not only used when fresh but are dried for winter use after being passed by special inspectors. Other fungi have medicinal values, or are used for staining wood, while the well-known yeast (*Saccharomyces cerevisiae*) is necessary to the baker and brewer.

See Cheel and Cleland's 'Disease in Forest Trees' in the 1918 *Report* of the New South Wales Forestry Commission, and their 'Australian Fungi' in the *Proceedings* for 1919 of the Royal Society of South Australia.

Fusanus, a genus of the family Santalaceae, consisting of trees or shrubs with small flowers, endemic in Australia with the exception of one species from New Zealand. The calyx-tube coheres with the corolla; lobes 4; stamens each subtended by a tuft of hairs; fruit a globular drupe, with a fleshy outer and a bony inner coat. *F. acuminatus* is the Quandong (q.v.); *F. persicarius,* a small tree, yields a kind of sandalwood. Its roots are used by the aborigines as a food, which is tasteless but nutritious, and is prepared by roasting the root in hot ashes. *F. spicatus* is the 'Fragrant' or 'Swan River' sandalwood of Western Australia. A comparison of its oil with a sample of genuine Madras oil (the sandalwood oil of commerce) shows that the Australian oil has a more fragrant odour, and resembles the Fiji oil obtained from *Santalum yasi.* Most of it, within 250 miles of Perth, has now been cut out. The average annual export of Australian sandalwood for the period 1918-23 was 9642 tons, valued at £157,532. The greater part of this went to Hong Kong and China; the Straits Settlements took about 20 per cent of it. The great bulk of the wood came from Western Australia.

Fustic. See Cudrania.

Fyans. Foster (1790-1870), entered the army at an early age, served in the Peninsular war, and at its conclusion exchanged into the 4th (King's Own) regiment, in which he was commissioned captain in 1826. The regiment reached Sydney with Sir R. Bourke (a former commander) in 1831, but Fyans was left behind to bring out later detachments; he reached Sydney in 1833, was at once despatched to Norfolk Island to report on the condition of the settlement—he distinguished himself there by helping to put down a mutiny and by introducing the first horse into the island—and on return to Sydney was for a time stationed at Parramatta. In 1835 he was appointed commandant at Moreton Bay, where he was host to the Quakers James Backhouse and George Walker; in 1837 he was transferred to Geelong as police magistrate and protector of aborigines, and proved himself a better magistrate than protector. Accordingly in 1840 he was made commandant of 'border police,' a body composed, it is said, of 'refractory soldiers and ticket-of-leave men,' set to keep order in the district between Geelong and Portland Bay. In 1843 he became commissioner of crown lands for Portland Bay, and in 1846 for the Port Phillip district; soon afterwards the border police force was disbanded, and Fyans returned to his post as magistrate, becoming in 1853 sheriff of Geelong. Shortly afterwards he retired from public life, settled down on his estate at Fyansford (Balliang), and died there on 23 May 1870.

Fysh, Sir Philip Oakley (1835-1919), born at Highbury in North London on 1 March 1835, migrated to Tasmania in 1859 to become manager of the Hobart branch of a London mercantile firm. In 1865 he came into public notice as a strong advocate of railway communication between Hobart and Launceston, and almost immediately entered the legislature. He sat in the council as member for Hobart (1866-9) and Buckingham (1870-3, 1884-94), and in the assembly as member for East Hobart (1873-8) and North Hobart (1894-8); he was treasurer in the Kennerley ministry (4 August 1873 to 13 March 1875), premier without office (9 August 1877 to 5 March 1878), premier and chief secre-

tary (30 March 1887 to 17 August 1892), and treasurer in the Braddon ministry (14 April 1894 to 30 December 1898). From March 1875 to June 1876, and in March-December 1878, he was minister without office in the cabinets of the time. During his 1887-92 term of office he was drawn into the campaign for federation, and represented Tasmania at the convention of 1891, but allowed his attorney-general, A. I. Clark, to take the lead in actual work for this cause, preferring himself a more modest measure of tariff reciprocity with New South Wales. Under Braddon's influence he showed more enthusiasm, was elected a representative of Tasmania to the 1897-8 convention, and became a member of the finance committee; when the bill was framed, he threw himself vigorously into the local campaign for its acceptance. At the end of 1898 he left office to take the agent-generalship, and acted as delegate from his colony in procuring the passage of the bill through the Imperial parliament. Returning to Tasmania in 1901, he was elected to the federal house of representatives in that year for his State, and in 1903 and 1906 for Denison; from April 1901 to August 1903 he was an honorary minister under Edmund Barton, and from the latter date to April 1904 postmaster-general under Alfred Deakin. He retired from politics in 1910, and died at Hobart on 20 December 1919. (K.C.M.G., 1896.)

G

Galah. See COCKATOOS.

Gang-gang. See COCKATOOS.

Gannets, large marine birds, mostly inhabiting tropical seas, which belong to the family Sulidae. They are represented on the Australian coast by four species, of which three inhabit tropical seas and the fourth temperate waters. Of the tropical forms the best-known is the Brown Gannet or Booby (*Sula leucogaster*), which breeds in great numbers on some of the islets of the Barrier Reef, and of northern and north-western Australia. The Australian Gannet (*S. serrator*) is common round the whole southern coast of Australia during the winter months; but the only known 'gannetries' in our seas appear to be those on Cat Island in the Furneaux group, Bass Strait, and on Lawrence Rocks off Portland in Victoria. J. Gabriel, when he visited Cat Island in 1908, estimated that about 2500 birds were seated on their nests, and Dr. W. MacGillivray found about 200 nests on Lawrence Rocks in 1900. Three colonies of the same species are known on islets off the North Island of New Zealand. W.B.A.

Gardiner, FRANK (1830-1895?) whose true name was Francis Christie, was born in 1830 at Boro Creek near Goulburn, moved to the Port Phillip district while still a boy, and in 1850 was sentenced to five years' imprisonment in Pentridge gaol for horse-stealing. Within five weeks he broke gaol, escaped to the Bendigo diggings and thence to Goulburn, and in 1854 was sentenced to seven years' hard labour for stealing more horses. After serving about half his sentence he was let out on ticket of leave, settled near Carcoar, and soon became a known and feared bushranger, acting with (or in concert with) John Piesley, another ticket-of-leave man from Bathurst. During 1861 they haunted the roads from Bathurst to the Lambing Flat diggings, occasionally 'sticking up' coaches between Gundagai and Yass. When Piesley left him (to be caught and hanged in March 1862), Gardiner formed a regular gang, with headquarters in the Weddin ranges south of Forbes, and during 1862 carried out a series of raids and robberies which culminated in the Eugowra escort robbery of 15 June, at which he secured about £12,000 worth of coin and gold dust in transit between the Forbes goldfield and the Bathurst banks. This was Gardiner's last exploit; his companions John Gilbert and Ben Hall carried on operations for three years longer, but he disappeared from the colony, and was only discovered in March 1864 keeping a hotel and store at Apis Creek, about 70 miles NW. of Rockhampton in Queensland. He had resumed his proper name 'Christie,' and was carrying on his trade normally and as a decent citizen should. Consequently, when a Sydney detective arrested him and obtained his remand to Sydney on the charge of having committed highway robberies in New South Wales, a good deal of sympathy was aroused for him. At Sydney the charges were more specific; on 17 May he was acquitted of one attempt to murder, but on 8 July was convicted of two armed robberies and another attempt to murder, and Chief Justice Stephen —probably influenced adversely by the expressions of sympathy, so unaccountable to men who had suffered from his depredations—sentenced him to 32 years' hard labour, by making the sentences (15, 10 and 7 years) consecutive instead of—as was the usual practice—concurrent.

Eight years later, Gardiner having meanwhile established a record of consistent good behaviour (and invented a contrivance for improving the selvage of matting made in the gaol), his sisters petitioned Governor Robinson for a pardon, and were supported not only by W. B. Dalley (who had defended him at both trials) but by the then colonial secretary, William Forster. The chief justice refused to recommend any mitigation of the sentence, and the governor would only grant a pardon to take effect two years later and on condition that Gardiner left the colony. In spite of much public and parliamentary opposition, this pardon was made effective on 20 July 1874. Sir Hercules Robinson gave it as his personal opinion that Gardiner could have been allowed to stay in New South Wales without danger, and the chief justice on this occasion recommended the pardon. On the 27th he left Newcastle for China, and crossed thence to San Francisco, where for many years he kept a hotel. The date of his death is uncertain, but was about the middle of the nineties.

Garfishes, members of the family Hemirhamphidae of great economic importance, and always in evidence at the fish-markets, being ranked among our most delicately flavoured table-fishes. Immense quantities are netted annually in our estuaries and along the coasts. They have elongate bodies covered with thin deciduous scales; the lower jaw projects as a spear-like prolongation of variable length, the purpose of which is not evident. In England and America they are known as 'half-beaks,' and the name 'garfish' is used for allied fishes of the genus *Belone*. The Australian garfish is in New South Wales also known as 'guard-fish' and 'beaky.' Garfish move in shoals near the surface of the water, and have the habit of leaping into the air when pursued; some have enlarged pectoral and ventral fins, which enable them to glide through the air for short distances in the same manner as their near relatives, the flying-fishes. Over a dozen species are known from Australian seas, including sea garfish, river garfish, short-beaked and long-beaked garfish. See LONG TOMS.

A.R.McC.

Garran, ANDREW (1825-1901), third son of Robert Gamman, a London merchant, was born at Bethnal Green on 19 November 1825, educated at Hackney grammar school, Spring Hill college, Birmingham, and the university of London (B.A., 1845; M.A., 1848), and in 1850 migrated for his health's sake to South Australia. There he for two years edited the *Austral Examiner* (which, like other venturesome enterprises of the day, was killed by the rush to the Victorian goldfields) and for another two years (1854-5, after an interlude as tutor on a Victorian station) the *South Australian Register*. In 1856 he moved to Sydney to be assistant editor of the *Sydney Morning Herald* under John West (q.v.), succeeding him as editor in 1873 and holding the post until ill-health forced him to resign in 1885. During this time he studied law at the university of Sydney, and in 1870 took the LL.D. degree.

Relieved of editorial work, he threw himself into politics as a free-trader, though never as a partisan, and in 1887 Henry Parkes nominated him to the legislative council. Three years later he proposed the appointment of a royal commission on strikes, of which he was given the chairmanship; when the commission's report resulted in the establishment of a council of arbitration, he became its president, resigning his seat in the council to do so. In 1894, however, he withdrew from the council of arbitration, was reappointed to the legislative council on 19 March 1895, and represented the Reid ministry in that body until 1898. Next to arbitration his chief interest at this period of his life was federation; in 1890 he was the spokesman of those free-traders who set federation above their views on economics, and greatly assisted Edmund Barton in the council debates through which the convention of 1891 came into being. Among other tasks he undertook the editing of the *Picturesque Atlas of Australasia* (1886)—a monumental illustrated description of Australia and New Zealand—and was for many years Sydney correspondent of *The Times*. He died at Sydney on 6 June 1901.

Garran, SIR ROBERT RANDOLPH, son of Andrew Garran mentioned above, was born at Sydney on 10 February 1867, educated at the Sydney grammar school and University (B.A., 1888; M.A., 1899), and trained for the bar, but at an early stage of his career entered public life as a helper in the campaign for federation. Attaching himself to Edmund Barton, he rendered good service to the federal cause as secretary to the drafting committee of the 1897-8 convention, as a councillor of the Federation League from 1893-1900, and as an author. He published *The Coming Commonwealth* (Sydney, 1897) and collaborated with John Quick in producing *The Annotated Constitution of the Australian Commonwealth* (Sydney, 1901) a storehouse of constitutional precedents. In 1901 he was made departmental secretary to the federal attorney-general, and combined that office with that of parliamentary draftsman until 1916, when he was appointed solicitor-general to the Commonwealth—a non-parliamentary and non-partizan office. His value to all the Federal cabinets both as an authority on the constitution and as a non-political adviser of sound judgment and great impartiality has been considerable, especially during war-time, when constitutional and legal difficulties occurred at every turn. He accompanied William M. Hughes, then prime minister, to the peace conference of 1918-9, and his successor Stanley M. Bruce to the imperial conference of 1923. (C.M.G., 1901; Kt. Bach., 1917; K.C.M.G., 1920.)

Garrick, SIR JAMES FRANCIS (1836-1907), born in Sydney in 1836 and educated there, settled in Brisbane soon after the separation of Queensland, practised as a solicitor there (being for several years city solicitor), and in August 1867 entered the Queensland assembly as member for East Moreton. In 1870 he visited England to improve his knowledge of law, studied at the Middle Temple, and on 7 June 1873 was called to the bar. Returning to Brisbane, he was crown prosecutor from 1874 to 1877, and then re-entered politics and joined the Douglas ministry as secretary for lands (6 February 1878) and attorney-general (7 December 1878). From January 1879 to November 1883 he was in opposition, a McIlwraith ministry being in power, but in the latter month he joined Samuel Griffith's first ministry as colonial treasurer (13 November to 31 December), postmaster-general (13 November to the following 24 June), and finally minister without portfolio (24 June 1884 to 13 June 1888); for Griffith, though he had many colleagues whom it was necessary to gratify with portfolios, was loth to deprive himself of the courtly diplomatic skill which was Garrick's, as it was his own, marked characteristic. He therefore in 1885 made Garrick agent-general for the colony, but still retained him in the ministry. During the succeeding McIlwraith and Morehead ministries (1888-90) Garrick returned to Brisbane, but after the coalition of McIlwraith and Griffith in 1890 was reappointed agent-general. He resigned this post in 1895, and died in England on 12 January 1907.

Garrick's political career was that rather of an adviser than of an administrator; while the specifiable results were small, the effect of it on colonial and Australian politics was probably of great importance. He represented his colony at the intercolonial conference of 1883 and the colonial conference in London in 1887. In 1921 the James Francis Garrick chair of law in the university of Queensland was founded under the will of his daughter, Katherine C. Garrick. (C.M.G., 1885; K.C.M.G., 1886.)

Gasteropods. See MOLLUSCA.

Gastrolobium, a genus of the family Leguminosae, consisting of shrubs with opposite or whorled, usually rigid, leaves, found chiefly in Western Australia. The flowers are yellow, frequently with a red keel, usually in clusters; pod oval, leathery. Several species are known as poison-bushes. *G. bilobum* (Heart-leaf Poison-bush), *G. calycinum* (York-road Poison-bush), and *G. ovalifolium* (Bloom Poison-bush —but this name is also applied to an *Oxylobium*, q.v.) are confined to Western Australia. Large numbers of cattle are lost annually through eating these shrubs, the finest and strongest animals being the first victims; the fact that losses chiefly occur during the flowering period indicates that the blooms are the most poisonous part of the plant. Horses, according to the general opinion, are not affected. *G. spinosum*, the Prickly Poison-bush of the Victoria Desert (W.A.), is regarded as poisonous to camels. *G. grandiflorum* (Wallflower or Desert Poison-bush), found right across Australia in northern latitudes, is said to have poisoned large numbers of sheep on the Flinders and Burdekin Rivers.

Gawler, GEORGE (1795-1869), son of Captain Gawler of the 73rd regiment, was born on 21 July 1795, educated at the royal military college at Marlow, appointed ensign in the 73rd regiment in 1810, and served with his regiment in the Peninsular war, being one of the four officers who led the forlorn hope at the storming of Badajos—this gave him his lieutenancy. At Waterloo he led a company against the Imperial guard in the charge which decided the battle. Promoted captain in 1825, major in 1831 and lieutenant-colonel in 1834, he then retired from active service. Meanwhile, in 1819, he had become a devout Christian—a fact which stood him in good stead when the colonization commissioners of South Australia were seeking a successor for Hindmarsh (q.v.); with such men as George Fife Angas to back him, and a letter of high praise from Lord Hill, the commander-in-chief, he easily obtained the governorship of the new colony, and landed at Glenelg on 13 October 1838. As he was both governor and resident commissioner, the disputes which had ruined Hindmarsh's career were henceforth impossible.

But Gawler was soon immersed in troubles of his own. The land regulations, excellent theoretically, had proved unworkable in practice. Landowners stayed in Adelaide instead of employing labour on their country farms; labourers demanded high wages or moved to other colonies where they could buy land at lower rates; the settlement, instead of being self-supporting, had to be fed from outside, and most of its cash went away to pay for food. Gawler found himself obliged to start relief works near Adelaide, which kept the poorer settlers alive, but withdrew them still more from farming. He spent the whole of his private means, and drew bills on the authorities in London for £155,000 more. This stirred the commissioners beyond reason; he had, they said, not only exceeded his authority but jeopardized 'the principle of self-support in South Australia,' and they at once procured his recall. The first intimation he had of it was contained in a letter from George Grey, his successor, who was apparently entrusted with the official letters, and sent Gawler a warning unofficially the very evening he landed in the colony. The blow was severe, and—though subsequent enquiries resulted in his complete exoneration—Gawler never recovered from it; he returned to England in 1842, and devoted the rest of his life to private beneficence. In 1850 he formally retired from the army, and died at Southsea on 7 May 1869. Both before and after his South Australian term he wrote a good deal. In 1833 he published *The Close and Crisis of Waterloo,* in 1837 *The Essentials of Good Skirmishing,* and in 1859-60 was one of the editors of the *Historical Records of the 52nd Regiment.* (K.H., 1837.)—His son Henry, born at Quarndon in Derbyshire, England, on 12 August 1827, accompanied his father to Adelaide in 1838, and to England in 1842, was educated at Rugby and at King's College, London, and was in 1852 called to the bar at the Middle Temple; he returned to South Australia in 1857, and became solicitor and permanent counsel to the lands titles commissioners shortly after the passing of the Torrens act (q.v.). Although never in parliament, he was twice attorney-general—in the brief Waterhouse ministry of October 1861, and for four days in the Boucaut ministry of 1875-6. His knowledge of the Torrens land registration system was so full that in 1870 the New Zealand government invited him to supervise its introduction into that colony. He died at Adelaide in December 1894.

Geebungs are the partly edible fruits of certain species of *Persoonia,* a genus of the family Proteaceae, which consists of shrubs or small trees with entire alternate leaves, ranging from cylindrical and heath-like to very broad and flat. One species occurs in New Zealand; the rest of the genus is endemic in Australia. The corolla segments are free, recurved in the upper portion; anthers shortly stalked and inserted about the middle of the segments; fruit a drupe, with a succulent coat and a bony seed. In several species the tips of the corolla segments are produced into prominent points—a useful character in classification. Some species are ornamental in habit, and are easily propagated from seeds; the succulent coat should be stripped off, and the seeds sown before the bony inner coat hardens. The timber of *P. lanceolata,* one of the first species to receive the name 'geebung,' is sometimes known as 'bonewood,' on account of its hardness. The name is a corruption of the aboriginal name 'jibbong.'

Geese. See DUCKS AND GEESE.

Geijera, a genus of the family Rutaceae, consisting of trees or shrubs, with alternate simple leaves, endemic in Australia. The flowers are small, in terminal panicles. *G. parviflora,* the Wilga of the western plains, is a small tree (20-30 feet) which ranges across the continent from Queensland to Western Australia. An excellent shade tree, it can withstand extreme drought, and is highly esteemed as a fodder-plant for sheep. Its timber is pale-coloured and close-grained, but is subject to gum vein and liable to split. *G. salicifolia* (Ironwood) has a hard, heavy timber recommended for veneering. The bark contains a bitter principle.

Gellibrand, JOSEPH TICE (1786-1837), born in London in 1786 and educated for the legal profession, was called to the bar in London, and in 1823 made by Bathurst attorney-general of Tasmania. Reaching Hobart in company with the new chief justice, John Lewes Pedder, on 16 March 1824, he took a prominent part in establishing the first supreme court of Tasmania, but soon came into collision with both Pedder and Arthur over a point of professional practice. He had drawn the pleas for the plaintiff in a certain case, and later, finding himself compelled as attorney-general to appear against this plaintiff, had transferred his fees to Alfred Stephen; it was not alleged that any failure of justice had resulted, and leading English barristers (including Sergeant Talfourd) approved of Gellibrand's action. Pedder declared that he was not bound by English practice, stigmatized the custom as pernicious, but dismissed a motion to strike Gellibrand off the rolls; Arthur, taking the hint, appointed a commission of enquiry (which included Pedder), and on its report dismissed Gellibrand from his official post, while Bathurst in 1827 cancelled his magistracy for having appealed to the colonial office behind Arthur's back. In that year, therefore, Gellibrand was merely a barrister of the supreme court, free to pursue his own ends. He bought Andrew Bent's newspaper (see BENT, ANDREW) but could not procure from Arthur a licence to issue it. He joined Batman (q.v.) in a proposal to establish a

settlement at Western Port (11 January 1827); but Darling, having just received from his colonizing expedition of 1826 unfavourable reports on the locality, rejected the proposal, and Huskisson's order to maintain the settlement and allow new colonists to join it (20 January 1828) reached New South Wales too late to make any difference. For several years Gellibrand continued to practise his profession, combining it, according to Widowson's *Present State of Van Diemen's Land* (1829), with a little private banking. When Batman in 1835 crossed to Port Phillip it was Gellibrand's carefully prepared deeds of transfer that he put before Jaga-jaga and his fellow-chiefs for signature; the lawyer joined Batman's association, and even drew up a form of government for the new settlement, which might have proved admirable if the territory had not been already part of New South Wales. In 1836 he himself crossed to Port Phillip in an attempt to reconcile the conflicting claims of the Batman and Fawkner parties; returning to Hobart to enlist Arthur (whose nephew was a member) on the association's side, he heard that Bourke was expected in Port Phillip shortly, and hurried back to meet him. Landing in Corio Bay on 21 February 1837, he started with a friend to ride to the Yarra by way of the You Yangs, but apparently lost his way, struck west instead of north-east, and was never seen again, though search parties were in the field for many months afterwards. Years later it was reported (but never definitely confirmed) that relics of Gellibrand had been found in the Otway forest.

A son, WALTER ANGUS BETHUNE GELLIBRAND, was a member of the legislative council of Tasmania from December 1871 to December 1893, and its president in 1884-9. A grandson, SIR JOHN GELLIBRAND (not a son of the last-mentioned), born in Tasmania on 5 December 1872, was sent to England for his education (at King's School, Canterbury and the Royal Military College), entered the army, fought in the South African war as a subaltern in the South Lancashire regiment, rose to be captain in the Manchester regiment, and retired to Tasmania when his battalion was disbanded in 1907. In 1914 he volunteered for service in the A.I.F., was appointed to General Bridges's staff with the rank of major, rose to be D.A.A. and Q.M.G. of two Australian divisions, then to the command of a battalion (the 12th), two brigades (the 6th and 12th), and a division (the 3rd). He was specially distinguished as a trainer of young officers, and was the leader chiefly responsible for the Australian success at Bullecourt in May 1917. On his return to Australia he was made public service commissioner of Tasmania (July 1919), then commissioner of police in Victoria (August 1920), and then returned to Tasmania to cultivate his apple orchard. (D.S.O. and bar, 1916; C.B., 1917; K.C.B., 1919.)

Gemstones. The most important gemstones, other than diamonds (q.v.) and opals (q.v.), found in Australia are sapphires. Sapphires were found near Burrandong in New South Wales in 1851; the present yield is derived chiefly from the Inverell district, which in 1922 produced 3437 oz. valued at £2830 (including small values for zircons and corundum); a few sapphires are found near Tingha. In Queensland the principal centre is on the Anakie mineral-field, whence stones to the value of £35,362 were obtained in 1922; sapphires of inferior quality are also found in the gem deposits at Woodbine and Diamond Hills. Small stones of little, if any, commercial value abound in the tin drifts of the Ringarooma and Portland districts in Tasmania. The total value of the sapphires won in Australia in 1922 was £38,192.

In 1890 emeralds were found near Emmaville in New South Wales, 2225 carats being sent to London during that year. In 1894 turquoises were discovered near Bodalla in New South Wales; they have also been found in thin veins in Victoria. The occurrence of tourmalines (found at Kangaroo Island in South Australia), topazes, agates, rubies, beryls, amethysts, chiastolite, garnets, olivines, and moonstones is also on record, but no returns were given for any of these minor gems in the official figures of 1922.

Gentianaceae, a family of herbs abundant in temperate or mountain regions north of the equator, with a few southern species. Five genera with 24 species are indigenous to Australia. The flowers are ornamental; fruits capsular; leaves opposite, entire. *Gentiana* is a large genus well known in alpine regions. *G. montana* has bell-shaped flowers; the corolla is white with a yellowish base, veined with blue. It is found on Mount Kosciusko and the higher ranges of Victoria and South Australia, extending also to Tasmania and New Zealand. *Erythraea australis* (Native Centaury), like the English centaury and many other species of the family, contains a bitter principle in its vegetative parts; from it is derived a useful tonic, especially valuable in dyspepsia.

Gentiana grisebachii.

Geodesy. Though many surveys have been made in Australia, chiefly in view of land settlement, trigonometrical surveys of high precision are, so far, confined to the three eastern States.

In *New South Wales* about a third of the whole area has been covered with a trigonometrical survey, which was begun in 1867, interrupted in 1884, resumed in 1891, continued until 1916, and then suspended because of financial stringency due to the war.

The first base-line, 5½ miles long, was laid down at Lake George. The standard of length was 'Standard Bar O.I.4,' obtained from the Board of Ordnance in England, and recorded in Clarke's *Comparison of Standards.* The base was measured with three 10-ft. bars of pine, encased in wooden troughs six inches square, with the ends of the bars slightly projecting; each end was fitted with a brass plug, on which a terminal dot was marked. These lengths were standardized every morning and

evening by comparison with the standard bar. Each trough was supported on two 'camels,' by which the three bars could be accurately levelled and placed along the line with the terminal dots in close pairs, leaving a small and constant free space between the bars. This adjustment was made with a double microscope. The difference between lengths obtained by measurement and by re-measurement was 0.54 in. in the 5½ miles. A second base, about seven miles long, was measured at Richmond (west of Sydney) in 1879-80, first with pine bars, then with steel rods. The difference between the lengths so obtained was 0.66 in. The two bases are roughly 130 miles apart. Calculation of the intervening triangulation showed an error of closure on the bases of 1 in 210,000. The subsequent triangulation extends more than 400 miles north-west of a line roughly joining the two measured bases. For the higher purposes of geodesy the survey may, therefore, be said to hang, for the most part, in the air. A third base, 20 miles long, was selected in 1916 at one edge of the survey, and the triangulation was connected to it. Sets of 'invar' measuring apparatus had already been procured, but the suspension of the survey prevented measurement.

The primary stations of the survey are, for the most part, from 30 to 40 miles apart; the secondary rays are usually from 15 to 20 miles long, and the ordinary length of rays to points intersected, but not occupied, is from 5 to 10 miles. At primary stations the observations were at first made with an 18″ altazimuth, latterly with a 10″ universal instrument. At secondary stations a light 10″ altazimuth has been used. The observed direction from one primary station to another of the first order depended on 40 pointings of the telescope, made under various arrangements of the circles of the instrument. For stations of the second order 20 pointings were made, and 10 for intersected points. In 172 primary triangles, the angles of which were all measured with the 18″ altazimuth, the average closing error was 0.71″, and in 29 triangles measured entirely with the 10″ universal instrument the average was 0.61″. In 271 triangles, each of which was formed by two primary stations and one secondary, the average closing error was 1.13″; in 278 triangles formed by one primary and two secondary stations the average was 1.30″; and in 179 triangles formed wholly by secondary stations the average was also 1.30″. This is good evidence of accuracy.

At most primary stations observations were made for latitude and azimuth, and, in some cases, for longitude also. Using Talcott's method for latitude, 50 or more pairs of stars were observed at each station. The 'probable error' of the mean latitude so determined for a station averaged 0.09″. Azimuth was observed by the method used to determine the azimuth error of a transit instrument in a fixed observatory. The transits of pairs of circumpolar stars differing in right ascension by nearly 12 hours were recorded by means of a chronograph. Four pairs were observed on each of five nights under arrangements of the circles of the altazimuth similar to those used for observation of horizontal directions. The 'probable error' of the mean azimuth so determined at a station averaged 0.16″. Longitude was observed on from three to five nights by telegraphic connections with the Sydney observatory. The geodetic latitudes, longitudes, and azimuths of the primary stations were computed by the formulae given at p. 252 of the *Report for 1858* of the ordnance survey of Great Britain. The position of the Sydney observatory, as given in the *Nautical Almanac* for 1890 and onwards, was adopted as origin; the azimuth of the meridian mark of the same observatory, as determined by the government astronomer, is the initial azimuth of the survey. The dimensions of the spheroid of revolution used in the calculations are:—

Major semi-axis = 20,923,134 feet,
Polar semi-axis = 20,853,429 feet.

These appear to have been derived from the early calculation by Clarke of the axes of the earth considered as an ellipsoid (*Memoirs* of the Royal Astronomical Society, vol. xxix), by taking the equatorial semi-diameter corresponding to longitude 152° east. The calculations of the survey have revealed discrepancies between the astronomical and geodetic values of latitude, longitude and azimuth. These, however, are not nearly so large as in India and America, the mountain masses of Australia being comparatively trifling. In the absence of topographic data, and of bases of verification for the bulk of the triangulation, the data provided by the survey have not been systematically treated in relation to the problems of isostasy and the figure of the earth.

In *Victoria* a base nearly five miles long, situated on the Werribee plains, was measured in 1860, and afterwards extended by triangulation for a further 5½ miles. It was measured with three iron bars 10 feet long and 1 inch square, one end of each bar being finished flat and polished, the other as a segment of a sphere of five feet radius, also polished. They were encased in wooden troughs 10 inches square, with hinged tops cut in three sections for the easy reading of the three thermometers resting on each bar, the ends of the bars being exposed for 2½ inches. Their lengths were compared with the 10-ft. ordnance standard lent by the New South Wales government, and later with a standard directly obtained from the British board of ordnance. The three bars were levelled and placed in series at distances of about ¼-inch between the spherical end of one and the flat end of the next; the distance between the two was obtained by passing between them a graduated wedge of bell-metal seven inches long and two inches broad, with faces inclined at angle of ½°. Within ten years the triangulation was extended throughout the colony, south of S. lat. 36°, over an area of about 70,000 square miles; 209 stations of the first order and 267 of the second order were connected and marked, an average number of 170 observations being made at each of the primary stations to determine their positions.

The marking of the boundary line between New South Wales and Victoria, begun in 1870, formed the occasion for the connection of the independent trigonometrical surveys of these States to four common points. The two sets of geodetic latitudes so obtained agreed within 0.25″, and the longitudes differed by from 7″ to 8″ (of arc). When the triangulation was extended westward, to Mount Gambier and Mount Schank in South Australia, a site for a base of verification was selected, but the measurement was not carried out.

The trigonometrical survey of *Queensland* extends approximately from 26°30′ to 29°30′ latitude, and from 151°15′ to 153°15′ longitude, and comprises 74 triangles with a base-line

about seven miles long at Jondaryan. The base was measured in 1884 with two steel tapes 100 feet long, half an inch wide, and a tenth of an inch thick; these were compared with an octagonal steel bar 10 feet long, 1½ inches in diameter, kept floating when in use in a trough of mercury, into which thermometers were plunged to obtain the temperature of the bar. This bar was compared in 1883 with the New South Wales 'Standard Bar O.I.4.' In the base measurements the two tapes were placed in wooden troughs shaded by a board, and a tension of 20 lb. applied by spring balance; five thermometers, whose index errors had been determined, were used along each 100 feet of tape. The troughs were supported on pegs set on even grade with a level, and marks were made in copper disks inserted in the pegs at intervals of 100 feet, the distance between tape ends and marks being measured with micrometer microscopes. Three measurements were made with each tape, and the mean results from the two tapes showed a difference of 0.12 in.

As a rule, ten-inch theodolites were used. The horizontal directions were obtained from two to eight readings made on each of 11 positions of the circle. The closing errors were within 1″ for 29 triangles, from 1″ to 2″ for 29 other triangles, from 2″ to 3″ for 11, and upwards of 3″ for 5 triangles giving an average error of 0.95″. The astronomical datum is the position of the station at Jimbour, as determined by Captain Morris, R.E. and Lieutenant Darwin, R.E. when observing the transit of Venus in 1882. The longitude was determined by telegraphic exchanges with the Sydney observatory. The azimuth datum was that determined with a transit instrument at Bloodwood, this being the apex of one of the triangles standing on the base-line. A minor triangulation of the city of Brisbane was carried out in 1890. The principal triangulation was discontinued in 1891.

In May 1912 a conference of surveyors-general of the States, held at Melbourne, passed a resolution favouring a geodetic survey of Australia to be undertaken by the Commonwealth government, in order to co-ordinate the work of the States, and to provide a common standard of accuracy. A similar resolution was passed by the Pan-Pacific scientific congress, held in Sydney and Melbourne in 1923, to which Great Britain, the United States, France, Japan, and other important nations with interests in the Pacific sent distinguished representatives.

Few *pendulum observations* have been made in Australia. The earliest seems to have been made by Freycinet in 1819, the latest in 1913; all were apparently made independently of the official survey organizations. Some 24 results for the several State capitals are recorded in the reports of the 13th-16th Conferenzen der internationalen Erdmessung.

Before the Sydney observatory was established in 1857, 15 important observations of longitude made near Sydney showed, when reduced to the position of Fort Macquarie, a range of 12 minutes of arc. Captain Cook's determination, made in 1770, differed by 51″ from the value now accepted, and Admiral D'Espinosa's, made in 1793, by 22″.

When, in the sixties, the Sydney and Melbourne observatories were able to determine longitudes with superior instruments, it was found that the 141st meridian, which had been used to define the boundary between New South Wales and South Australia, lay about 2¼ miles east of the position previously accepted. The longitudes on which this result was based were:—Sydney, 10h 4m 48.97s; Melbourne, 9h 39m 54.8s. These values remained practically undisturbed till 1884, when for the first time an Australian meridian was connected with the prime meridian of Greenwich. Singapore had already been connected with Greenwich by telegraphic exchange of time-signals through Alexandria, Aden, Karachi, Madras, and some intermediate stations; and in 1884 the connection of Singapore with Port Darwin by cable, and thence by overland telegraph lines with prominent Australian observatories, completed the telegraphically determined chain of longitudes between Greenwich and Australia. The results were:—Port Darwin 8h 43m 22.49s; Adelaide 9h 14m 20.30s; Melbourne 9h 39m 54.14s; Sydney 10h 4m 49.54s. An independent determination of the longitude of Karachi was completed in 1896 by telegraphic exchanges through Potsdam, Teheran, and Bushire, and in 1906 the arc Greenwich-Potsdam was re-measured. These measurements gave a result diminishing the Australian longitudes of 1883-4 by 0.17s, the new value for Sydney being 10h 4m 49.37s.

In 1902 the Pacific cable was completed, linking Vancouver in Canada with Southport in Queensland, and in 1903-4 the authorities of the Dominion observatory used it to connect Canadian longitudes with those of Australia. As the connection between Canada and Greenwich had already been established, a circuit of longitudes round the earth was thus completed. The closing error was 0.25s, or 0.08s, according as the 1883-4 or the 1906 value by the Singapore route was used, the longitude of Sydney as determined through this new western route from Greenwich being 10h 4m 49.29s.

The development of wireless telegraphy offered a new means of exchanging time signals, and, after some preliminary trials, this means was systematically used in 1920 and 1921. In spite of the very small range of 0.15s among the results derived by cable, the direct connection of the Sydney observatory with Greenwich, by reception of wireless time-signals issued from Lyons on 13 days in April and May 1921, gave for Sydney the mean result 10h 4m 48.98s. This is 0.31s less than the smallest (that via Canada) of the cable determinations. Far more exhaustive was the series of observations of the longitude of Adelaide commenced in June 1920 and finished in July 1921. Comparisons were made with Greenwich, Paris, Ottawa, and Washington of wireless signals issued from Lyons, Bordeaux, and Annapolis, and the mean of 198 separate comparisons gave 9h 14m 19.78s for the longitude of Adelaide. This is 0.27s less than the cable determination through Canada, and is therefore in very close agreement with the wireless longitude of Sydney.

The longitudes of Perth in Western Australia, and of Deakin and Kimberley situated on the 129th meridian, have also been exhaustively observed by comparison with Greenwich, Paris, Sydney, and Adelaide of wireless signals, issued from Lyons, Bordeaux, Annapolis, as well as from Adelaide. The results derived from the several comparisons are in close agreement. Australian longitudes may be said to have now a very firm foundation.

See *Report* of the Conference of Surveyors-general (c. 6832, Melbourne, 1912); P. Baracchi's 'Australian Longitudes' in the *Proceedings* of the A.A.A.S. vol. 14, Melbourne, 1913; and G. F. Dodwell's 'Australian Wireless Longitude Determinations' in the *Report* of the Pan-Pacific Congress of 1923.

Geoghegan, Patrick Bonaventure (1811-1864), born at Dublin and educated at the Irish Franciscan Colleges at Lisbon and Coimbra (where he was ordained priest), after some years of mission work in Dublin volunteered for the New Holland mission, and sailed with Dr. Ullathorne in 1838. In May 1839 Bishop Polding transferred him to Melbourne, where on 19 May he celebrated the first mass recorded at Port Phillip. His strenuous work built up the church there so strongly that within eight years it was constituted a separate diocese, Father Geoghegan becoming its first vicar general. On 8 September 1859 he was consecrated bishop of Adelaide by Archbishop Polding in the church of St. Francis, Melbourne, which he himself had built. In his diocese he remained the 'diligent and earnest missioner, cheerfully spending himself for the good of souls,' whom Dr. Polding esteemed so highly; but ill-health overtook him, and he died suddenly on 9 May 1864, while on a visit to Kingstown in Ireland. E.M.O'B.

Geography, Economic. It is by no means sufficient for a geographer to state where a given product may be obtained; he should be able to say why it occurs there rather than in many other areas which at a first glance are equally suitable. Hence in this description of the resources of Australia the causal aspect will be emphasized.

Note the position of Australia in the world-map; perhaps the most useful map is one which shows the climatic regions as modified by the writer from the plan suggested by Herbertson (see Taylor's *Australian Meteorology*, p. 281). Australia is so situated along the tropic of Capricorn that a little over one-third of it is within the tropical zone. Similarly situated regions, with a considerable extent along the tropic, are found in South America and southern and northern Africa; in Asia and in Central America along the tropic strongly indented coasts preclude any close resemblance to Australia as a whole. But the high plateaux of southern Africa (and those, not quite so high, of South America) have no representatives in Australia; and it is in northern Africa that we find perhaps the most general resemblance to our own continent. If we superpose an inverted map of Australia over one including the Sahara and Mediterranean, we see how closely our fertile southern areas agree with the Mediterranean lands, while our interior corresponds in general character (though luckily not in relative extent) with the Sahara. Moving our inverted map eastwards along the tropic, we find a close resemblance between our tropical areas and those of the Indian peninsula. It is, therefore, with the Mediterranean, the Sahara, and southern India that we should compare our three main divisions of temperate, central arid, and tropical regions.

With regard to the temperate region it may be noted that by virtue of their winter rain and warm, dry summer our southern lands are well adapted for wheat. Yet Italy produces almost as much wheat as the whole of Australia, and Italy, Spain, and Algeria together in 1914 grew just twice as much.

Along the tropic in all three areas under comparison occur large arid tracts, whose extent is directly proportioned to their average distance from the sea. Thus the Sahara is the greatest desert which, owing to the vast extent of equatorial Africa, approaches the equator most closely. The Australian desert, the second in extent barely reaches into tropical areas. The Indian desert (or Thar), owing to the comparatively slight width of India, is the smallest of the three. As they are similarly situated, so they have a similar origin, being due purely to the average isobaric distribution throughout the year. They all lie under the belt of high pressure, which is inevitably a region of descending air that becomes warmer and drier as it descends. On the equatorial side of this belt is the region of easterly trade-winds, by far the most important and extensive of all the permanent winds. The western areas of the largest land-masses, therefore, so far as they lie in the trade-wind belt, are swept by winds that have long since left the ocean (the natural source of their water-contents), and are approaching the equator; these winds, steadily becoming warmer and drier, absorb moisture from the land beneath them instead of giving it out, and so produce deserts.

A desert, it must be remembered, is not usually devoid of plants and covered with shifting sand. Even in the Sahara we get immense stony plains, and a sparse *Acacia* flora in many respects like that of central Australia. The word 'desert' is used here for lands at best only capable of very sparse settlement, and possessing a low rainfall—which in Australia seems

Map showing net Rainfall.
Black areas are those in which rainfall exceeds evaporation.

to approximate 8 inches in the south (with a reliable winter rainfall), and 16 inches in the north (with an unreliable rainfall and great evaporation). Vegetated sand-ridges under these conditions are quite uninhabited. Elsewhere sparse stock may flourish. The exact boundary is very debateable. In certain favoured areas (e.g. near Southern Cross in Western Australia), where the rainfall is assured and falls in the required season, a considerable crop of wheat can be grown, even though the total fall for the year is little more than ten inches. But these exceptional areas are relatively of very small extent.

The tropical division of Australia is comparable with peninsular India. The climates of Calcutta and Townsville are extremely alike as regards both rainfall and temperature. The climates of Wyndham in Western Australia and of Tinnevelly in the extreme south of India have also much in common; they appear to hold the record for a high average annual temperature (84° Fahr.), accompanied by a heavy monsoon rainfall (30 to 40 inches) and high humidity in summer.

In Tasmania we have a land-area cooler than any of those mentioned above, which corresponds very closely in climate and resources to Brittany and southern Britain.

Australia is therefore a continent of almost

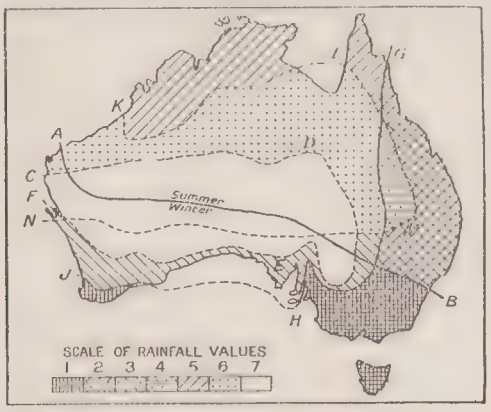
infinite variety. In the following table are indicated foreign regions enjoying similar conditions (homoclimes), Herbertson's scheme being used as a basis:—

Homoclimes with Australian Regions.

Australia.	Type of Rainfall.	Typical Resources.	Foreign.
Tasmania	Cool, uniform ...	Farming, dairying, forestry ...	Britain, British Columbia.
South coast-lands of Australia	Chiefly in winter ...	Wheat, vines, wool, dairying...	Spain, Italy, Turkey, Algeria, California, Chile.
New South Wales coast ...	Heavy, warm, uniform	Cattle, maize, vine, (cotton, tea)	Natal, Uruguay, Virginia, eastern China.
Western plains of New South Wales	Slight, warm, uniform	Wheat, wool, cattle	Inland Argentine, Mississippi Valley.
Northern monsoon area ...	Summer rains ...	Sugar, rice, cattle, wool ...	India, eastern Brazil, Portuguese East Africa.
Warmer arid area	Some summer rain ...	Pastoral	Kalahari Desert, Thar, northern Sudan.
Cooler arid area	Some winter rain ...	Pastoral (some dry-farming)...	Northern Sahara, California and Mexican Desert.

The rainfall map of Australia shows that zones of heavy rainfall surround the arid central and western regions. This map, however, since it does not indicate many essential features of the rainfall, is apt to be very misleading. Settlers need to know the character, reliability, and season of the rainfall even more than its annual amount. Consider four districts which have approximately 15 inches per year—Roebourne, Northam (both in Western Australia), Tennant's Creek in the Northern Territory, and Cobar in New South Wales. None of these are debarred from settlement by excessive heat or dryness; but two of them will never support a large population. The Roebourne region is marked by the most unreliable rainfall in Australia; in 1891 it received only 0.13 inch, while in 1900 there fell 42 inches, and its average rain-variability has been computed at 43 per cent. Tennant's Creek is chiefly characterized by an absolutely dry period of seven months (April to October); at Cobar the 15-inch rainfall is spread out almost uniformly through the year; Northam receives practically all its 15 inches during the wheat-growing season, and is district than Cobar, which is only barely within consequently a much more important farming the dry-farming area.

These boundaries are shown below, and an attempt is made to classify Australian regions according to their characteristic rainfalls. The



most useful type of rain is spread over the whole year, fairly abundant, and not liable to vary from the normal. This type is included in class 1 (winter maximum) and class 2 (summer maximum); class 3 includes the area of moderate and reliable rainfall chiefly occurring in winter. The above are all agricultural regions. Of great pastoral value is class 4 in central Queensland, which has a well-distributed rainfall—not, however, very reliable. The purely monsoonal regions of the north form the next two classes as they are reliable (class 5) or erratic (class 6). The arid region (under ten inches) includes the southern portion, where such rains as fall are fairly constant, and—the worst region of all—the unreliable northern arid moiety. From this map, used in conjunction with an average rainfall map, the pastoral and agricultural capabilities of any large area in Australia can be ascertained with fair accuracy.

A factor of equal importance in a study of economic geography is the distribution of the geological formations. The geology of the Commonwealth is treated more particularly elsewhere, but a brief note about it is relevant here. From an economic point of view Australian formations can be divided into four major groups, (1) the western peneplain (i.e. level or undulating surface, worn down by the long-continued action of rain and rivers); (2) the highly-folded early Palaeozoic highlands; (3) the moderately-folded Permian and Triassic coal-measures; (4) the level-bedded Mesozoic and Tertiary deposits. Their general relations to economic problems are shown in the following table:—

Group 1.

Geological formation.—Western peneplain, comprising most of Western Australia and the western portions of the Northern Territory and South Australia. Largely Palaeozoic rocks (pre-Cambrian in SW., Devonian and Carboniferous in NW., Cambrian in NE.). *Topography.* Undulating, low plateau of about 1000-feet elevation. Few high mountains, and no rivers except along the coast. Numerous shallow salt lakes. Sand-ridges characteristic of centre. *Climate.* Situated along the tropic in the trade-wind area. Generally arid, but with good seasonal rainfall to north and south. Better rainfall near Macdonnell Ranges. *Economics.* Much true desert in centre. Valuable saltbush and mulga country, gradually merging into grass-lands in the south and north. Valuable ores in the ancient rocks of SW. and NW.; ores rarer elsewhere.

Group 2.

Geological formation.—Palaeozoic highlands along the eastern and south-eastern coasts. Cambrian rocks in the Flinders Range. Largely Ordovician to Carboniferous on the west of the Divide (Secondary rocks involved in the Blue Mountains and southern Queensland). Large masses of granite are abundant, much faulted and penetrated by dykes, etc. *Topography.* Usually broad uplifted massifs, often flanked by faults and dissected by deep valleys, often they form the

divide between the Murray and the coastal streams. The chief uplift was probably in late Tertiary times. Many lava-flows associated with the uplifted areas, and in part constituting the Divide. Rise to 7300 feet in Kosciusko. *Climate.* In the north a heavy rainfall, as they intercept the permanent south-east trades. Elsewhere good rainfall, partly owing to uplift of moist on-shore winds. Climate greatly ameliorated in northern regions of Atherton plateau, Darling Downs, New England, etc. Alpine condition in the Monaro, Bogongs, etc., in SE. *Economics.* Many important metalliferous deposits are exposed in these ancient uplifted rocks. Chief dairying districts of Australia. Important forests. On the inner flanks of the southern highlands are grown the chief wheat-crops, and in the valleys and littoral of this group is the bulk of the population.

GROUP 3.

Geological formation.—Coal-bearing strata (chiefly Permo-Carboniferous and Triassic in age). Mostly level-bedded sandstones and shales, which occupy basins in the strata of group 2 along the eastern highlands. *Topography.* An integral portion of the highlands of group 2. In some cases the softer coal-measures have been subject to greater erosion, and so have determined the topography; e.g. Hunter valley and Blue Mountain valleys. Otherwise they partake of the general warping and uplift. *Climate.* Too small in area to have a marked climatic effect. Still, certain major gaps in the highlands correlate the coal-measures with the rainfall (e.g. in the Hunter valley). *Economics.* In the future large manufacturing industries will attract a dense population along the coal belt. This is already shown in the crowded condition of the lower Hunter valley.

GROUP 4.

Geological formation.—Water-laid sediments, which have not been folded or crumpled. They include deposits of Cretaceous and Tertiary age, and form a belt of lowland from the Gulf of Carpentaria to the Murray mouth. Around the latter is the largest area of Tertiary deposits. *Topography.* The rolling country forming the Great Artesian Basin is Cretaceous. The farther plains in the Riverina and lower Murray basin are of Tertiary age. Immense areas of superficial Tertiary deposits cover older rocks from the Barkly tableland in the Northern Territory to Eucla in the Bight. Rivers large, but rarely permanent. *Climate.* Rainfall primarily controlled by distance from the sea. In the north a summer rainfall due to tropical 'Lows.' In the south, Antarctic Lows give rain. In the centre there is very little dependable rain; what there is is largely due to thunderstorms. *Economics.* The great grazing country of Australia. The west is opened up by artesian wells. Opals are practically the only mineral, except where inliers of Palaeozoic rock are exposed.

WESTERN AUSTRALIA.—*Area*: 975,920 sq. m. (364,000 tropical, 611,920 temperate). *Rainfall*: arid area (under 10 inches) about 500,000 sq. m.; tropical rain area (over 10 inches) about 350,000 sq. m.; temperate rain area (over 10 inches) about 125,000 sq. m. *Population* (1921): 332,732 whites, 25,587 aborigines. *Chief Towns*: Perth (155,592), Fremantle (25,534), Kalgoorlie (19,213), Bunbury (4475), Geraldton (4174), Albany (3976). *Stock* (1922): cattle, 939,596; sheep, 6,664,135. *Chief Products*: wheat (1922-3), 13,857,432 bushels; timber (1922), 149,158,000 super feet; pearls and pearl-shell (1922), £215,385 in value; gold (1922), 538,246 fine oz.; silver (1922), 118,696 fine oz. *Railways* (1921-2): 4867 miles. For statistics of stock, products, etc., not given here see separate articles on HORSES, SHEEP, etc.

Topography.—The lozenge-shaped block constituting Western Australia, and forming one-third of the continent, is a splendid example of a peneplain. It is an extremely ancient land-surface, lying almost wholly between the 1000- and 2000-ft. contours. There are only two large areas exceeding 2000 feet. One in the centre of the State extends from Nannine to Lake Wells, and may be called the Wiluna uplands. The other, more imposing, lies between

the upper Fortescue and upper Gascoyne rivers, rises to over 4000 feet in Mount Bruce, and is bounded on the north by the well-marked scarp of the Hammersley Range. In the Kimberley regions are other local elevations (Mount Hann, 2800) which exceed 2000 feet. A well-marked ridge in the extreme south (the Stirling range), which rises sharply to 3640 feet, is a mass of old quartzites sharply differentiated from the surrounding granites and gneisses.

The mountain 'range' of chief economic importance runs parallel to the coast somewhat east of Perth. Like so many of our ranges, the Darling Range is really a scarp marking the edge of a fault, or the slope of a Tertiary fold. Here it separates the coastal plain, built of Tertiary sediments, from the extremely ancient gneisses, etc., of the great peneplain to the east. It rarely rises much above 1000 feet.

Hydrography—Coast.—Just west of the Territory border lies Cambridge Gulf, with Wyndham at its head. Proceeding westwards, the Kimberley coast contains many deep inlets (really drowned river-valleys) which are affected by abnormal tides; near Glenelg River there is a 36-ft. rise. King Sound at the mouth of the Fitzroy separates this 'ria' region from the less indented and shallower shores to southwards; it is notable for the great velocity (8 knots) of its tidal streams. The eastern portal of the Sound is Cape Lévêque, surmounted by a light. Roebuck Bay forms a good harbour for the town of Broome, the chief port on this coast. Here starts the cable to Java. Far-

ther south lies the Ninety-mile Beach, and the next important settlement is Port Hedland. Here and at the neighbouring ports, Cossack and Onslow, are lights visible over 10 miles. Exmouth Gulf is a wide indentation of little importance, passed just before reaching North-west Cape. There is a light on Vlaming Head at this cape. Coral-reefs make the navigation dangerous along the coast, and extend south to Houtman's Reefs off Geraldton.

Shark Bay is the chief indentation, and is divided into two by the low Peron Peninsula. The bold headland of Point Inscription, on Dirk Hartog Isle to the west of the bay, is crowned by a lighthouse. Dorre and Bernier Isles also separate Shark Bay from the Indian Ocean. Geraldton on Champion Bay has a regular coastal service to Fremantle, with which it is also connected by railways via Moora and Wongan. Rat Island, off Geraldton, has been worked for guano. Near Dongara, a small port on the Irwin River, coal has been found; and 100 miles south, at Jurien Bay, a curious submarine spring has been noted 600 feet from the shore.

Fremantle, the chief port of the State, is approached round Rottnest Island, which carries a powerful light visible 23 miles. Gage Road is the anchorage at the mouth of the Swan River. The next noteworthy inlet is Geographe Bay, north of the uplifted granite 'horst' of Cape Leeuwin. On its shore are Bunbury and Busselton, while to the west is Cape Naturaliste, a fine headland 400 feet high. At the extreme south-west of the continent is Cape Leeuwin, a somewhat insignificant promontory surmounted by a high lighthouse visible 21 miles. Along the south coast the cliffs are high (Point Nuyts 647 feet) all the way to King George's Sound. At the entrance to the latter is Breaksea light, which guides the shipping into Albany. East of this town there is very little settlement, except at Hopetoun and Esperance, and near the latter place the coast is fringed by the islets of the Recherche Archipelago. The shores of the Bight consist of abrupt cliffs from 200 to 400 feet high. Telegraph stations are situated at Eyre and Eucla, and the latter possesses the only anchorage for nearly 400 miles. The grand sweep of the Bight may be due to faulting, and to marine erosion acting on a uniform series of somewhat soft horizontal beds.

Rivers.—The rivers of the State are on the whole of little importance, but in the Kimberleys there are many fine streams, the Fitzroy being about 400 and the Ord about 300 miles long. These maintain a fairly strong flow, owing to the heavy summer rains, but are not of much use for navigation. The Fitzroy is blocked by sandbars and snags; the Prince Regent River to the north seems to have greater possibilities. The De Grey, Fortescue, Ashburton, and Murchison, though prominent features on the map, carry little water except after occasional floods. The Swan, Murray, and Blackwood above tidal limits are of no importance for navigation.

A vast proportion of Western Australia is totally devoid of rivers. Shallow valleys, resembling the wadis of the Sahara, carry the waters of occasional thunderstorms, but these are soon absorbed by the immense extent of thirsty sand. The lakes so profusely scattered on the map are shallow saltpans, and rarely contain water.

Artesian Water.—Of great importance, however, is the underground water, which is fortunately widespread, and is reached either by artesian or by shallow wells. Artesian water is developed in several basins. The Perth district water-supply is in part obtained from about 50 bores, over four million gallons a day being obtained at Leederville from a bore just over 2000 feet deep. In the dry country behind Shark Bay stock are benefited by 69 bores put down between Onslow and the Murchison. A large basin round Broome, which has been prospected (the town itself obtains its supply from this source), extends to the east considerably beyond Derby. The Eucla basin supplies somewhat brackish water along the transcontinental railway.

Wells.—The hydrography inland can be gathered from Talbot's report of his survey of Canning's stock-route. Some 50 wells were sunk along the line from Wiluna to Hall's Creek. There are no rain-gauges in this area, but, judging from the vegetation, the annual rainfall is not much over 12 inches. From Wiluna to Weld Spring sand-ridge, clay-pan, and mulga country occur, but natural waterholes are to be found every 20 miles or so. For the first half of the stock-route (800 miles) the wells were sunk to a depth varying from 12 to 104 feet, the average being about 36 feet. These yielded on an average about 1000 gallons per hour, though the flow varied greatly.

In the northern half of the route Canning made use to a greater extent of cleaned-out native wells and rock-holes, and well-sinking was not so necessary. At Mujingerra (near 23° S.) a most peculiar natural well occurs in the travertine; it leads to a cave about 150 feet long, containing a large pool of fresh water about four feet deep.

Talbot concludes as follows: 'Although at some future time the country along the lower portions of the Sturt River may become settled, the country along the stock-route beyond' (i.e. south-west from the Sturt) 'is never likely to become occupied by pastoralists.'

Population.—In a new country like Australia the economic factor is almost wholly responsible for the distribution of population. The boundaries between the States either are natural or follow geodetic lines. No strategic requirements, no relics of previous conquest or mismanagement, have complicated the political geography of Australia; we may therefore take the natural distribution of the population as a trustworthy guide in surveying the State's resources. There is a compact knot of 155,592 people at the metropolis—nearly one-half of the whole State; surrounding this district, and feeding it, are four well-populated blocks, the Northam district in the north-east (40,000), the wheat-belt running south-east to Albany (55,000), the coastal belt running south to Leeuwin (30,000), and the Geraldton district to the north with 8000 settlers. This well-settled area within the 10-inch rain-line has been conveniently termed 'Swan-land,' and contains 86 per cent of the population. Extending far into the arid region are the Kalgoorlie goldfield towns, holding a group of 30,000 similarly interested people. Parallel to them to the north is the Murchison group (4000). Yet farther north is the Pilbara field, with 1500. In the whole of the rest of the State, comprising four times the area already discussed, there are probably not 8000 inhabitants, and they are almost all clustered along the coast at Eucla, Esperance, Carnarvon, Broome, Wyndham, and similar places.

Products.—By far the most important product of Western Australia is *gold*, the output of

which exceeds in value 147 millions sterling, mostly produced in the last 30 years; more than half of this came from the Kalgoorlie district, which contains the famous 'Golden Mile.' The geological aspects of the goldfields are described elsewhere, but their distribution, lines of communication and centres of settlement belong properly to geography. If we draw a circle centred 60 miles west of Menzies, with a radius of 250 miles, we shall enclose all the most important goldfields. This area is a granite peneplain of great age, so eroded that the 'roots' of the formations are laid bare. The ore-deposits are always found near yet older inliers of gneiss and shattered eruptives (greenstones). These auriferous belts run from NW. to SE. in a parallel series, each belt being much interrupted; they have been 'tapped' by two railways crossing them at right angles. Along the eastern railway we come first to the Southern Cross mines in the Yilgarn field, then, after a barren stretch, to the famous Coolgardie, Kalgoorlie, and Kanowna series, with Norseman to the south. Running north along the belt, the railway taps the Menzies, Niagara, and Leonora mines, and the Laverton group E. of them. In the Murchison district is a similar series, served by the northern railway. First come the Yalgoo mines; then, after an interval of bare granite, the Mount Magnet, Daydawn, and Cue mines; in the third belt are the Meckatharra and Sandstone mines; farthest east, beyond the railway, is the Wiluna field. The Pilbara region behind Port Hedland is the only outlying goldfield of importance, but ranks below the southern fields; its two chief centres are Marble Bar and Nullagine, the former connected to the port by rail. Kimberley in the far north (Hall's Creek, etc.), Ashburton and Gascoyne in the north-west angle of the State, and Phillips River (served from Hopetoun on the south coast), are not great gold producers.

Minerals other than gold are of much less importance, but may conveniently be mentioned here. In the SW. corner of the granite peneplain, 130 miles south of Perth, is the Greenbushes *tin* field, where tin to the value of half a million has been produced. Unlike the goldfields, it is situated in a flourishing farming district with a rainfall of over 30 inches a year. A little to the north is the Collie *coal* field, also on a branch from the south-western railway. It is the only important coal-field west of Melbourne, and its geographical position gives it a special value. Another southern mineral field is situated behind Hopetoun, much *copper* being obtained from the Phillips River district. In the Pilbara fields in the NW. the tin and copper together have been as valuable as the gold, both groups having produced well over a million sterling.

It will be noticed that on the whole the valuable minerals occur in the arid portions of the State. This has resulted in the rapid opening up of much of the interior, so that, apart from mining, large areas of country carry some stock. Unfortunately the geological character of the country changes very greatly N. and E. of the great goldfields, making it very improbable that auriferous deposits on a large scale will be discovered in the unsurveyed centre. No doubt in the future the stock areas will expand farther eastwards, but for many years the central-eastern section of the State will remain unoccupied.

It is convenient to deal with the distribution of stock next, though wheat is second to gold in order of importance. Both as regards cattle and sheep this State, despite its dominating area, is only fourth in the Commonwealth. Stock of some sort is carried almost everywhere except in the arid centre. *Cattle* are most numerous in the north, and sheep along the western coast. The chief cattle region is in South Kimberley, along the Fitzroy and Ord Rivers, where there are 523,000 out of the State's total of 939,596 (1922). The north-western (Pilbara, etc.) and Peak Hill regions account for about 150,000 head. The cattle are driven to the ports by definite tracks, along which permanent wells are maintained by the government. Other stock-routes run from Broome and the north-west to more southern ports. Along the littoral both N. and S. of Perth are the chief dairy herds, but here sheep are of more importance. It will be seen that the cattle occupy the rougher and less accessible portions of the State. This is natural, since they can cover more ground in grazing, and can be driven longer distances than sheep. As railways are extended, and water-supplies are improved, sheep will replace cattle in many districts, as they have done all over Australia. The cattle-station is the pioneer of settlement, here as elsewhere. The relation of cattle to rainfall is not very close; but they do not seem likely to spread into the driest eastern areas, which are largely covered with sand-ridges. Here the rainfall is perhaps only seven or eight inches—but there are no rain-gauges in these districts, and probably no portion of Western Australia receives much less than seven inches.

About half the *sheep* are grazed in the well-watered south-western corner ('Swan-land'), especially near Geraldton and Katanning. These districts are, however, devoted to many other industries, and it is on the north-western coast near Carnarvon, and in the Pilbara district, that sheep are of paramount importance. Even so far north as Broome and the Fitzroy basin there are 165,000 sheep; it is evident that the tropical climate suits them well enough. As yet sheep have not penetrated far inland, except near the railways; the lack of permanent water is the chief obstacle. Since they do so well near Carnarvon, with an average rainfall of less than 10 inches, it is obvious that well-sinking and dams will gradually open up many square miles of empty country, whose rainfall is little below that at Carnarvon and probably no more erratic.

Interesting features of the pastoral country are the rabbit-proof fences. The chief of these extends from the north coast near Port Hedland to the south coast near Hopetoun, a distance of more than 1000 miles. Another (earlier) fence runs from Hopetoun north to Yalgoo and thence to Northampton on the west coast. These fences are inspected continually along their whole length and have to a considerable extent protected the pastoral areas from the rabbit-plague of eastern Australia.

Camels are an important asset in an arid State. There were 6473 head in December 1922, spread rather evenly throughout the outlying districts; most, perhaps, are to be found between Pilbara and Yalgoo.

Wheat-growing has quadrupled its production in the last 10 years. It is absolutely controlled by the rainfall, lying almost wholly between the isohyets of 10 inches and 30 inches (for April-October). York may be taken as the centre of production; thence it spreads north to Geraldton and south to Katanning. The

best areas seem to be those that receive from 15 to 20 inches in the cooler months. As pointed out previously, 'Swan-land' is admirable for wheat, in that the rainfall is the most reliable in Australia and falls almost wholly just when it is most required. A great development of railways has taken place of late years in the wheat-belt. The new northern line (from Mullewa to Northam), and all the numerous branches running eastward from the southern line (i.e. at York, Narrogin, Wagin, Katanning, and Tambellup) are primarily concerned with opening it up. As a whole it yields, by the present somewhat primitive methods, about 12 bushels per acre in a fair year.

Western Australia has the largest *timber* export industry of all the States; 227 million feet (super) were cut in 1914, all from the hardwood forests of the south-western corner; the industry suffered greatly during the war, but by 1923 had recovered to the extent of cutting 149,158,000 super feet. The timber-belt (that part of it at least from which timber is exported) is practically confined within the 20-inch rainfall line. But even with a rainfall of less than 10 inches the goldfields contain a fair growth of eucalypts that have become adapted to desert conditions.

The two chief timbers are jarrah (*Eucalyptus marginata*) and karri (*E. diversicolor*). The jarrah belt lies along the Darling scarp from Perth to the south coast. The trees average about 100 feet high, and are used all over the world for wood-blocks, pipes, etc. Karri extends chiefly along the south coast from Cape Leeuwin to Albany, especially in the Blackwood and Warren valleys. It is a larger and more graceful tree than the jarrah, and is used for similar purposes. The forest sawmills are most numerous along the railway branches south-west of Geographe Bay. Karridale, Augusta, Donnybrook, Pinjarra, Busselton, and Bunbury are largely interested in timber export. White gum (wandoo) is a smaller but very useful tree which grows along the southern railway. Sandalwood (*Fusanus*), a tree usually about 20 feet high, supplies an important export; it grows in similar country throughout the wheat-belt, as well as farther north. Of the total Australian export, valued in 1922-23 at £110,824, 90 per cent comes from this State. Two gums widely spread through the southern goldfields are the salmon gum and gimlet gum; they flourish where the rainfall is in the neighbourhood of 10 inches a year, and are invaluable for mining needs.

Apples grow splendidly in the karri district, south of a line joining Bunbury to Cranbrook. Many other orchards are scattered through the jarrah belt, where oranges also thrive. The *vine* country lies between the wheat-belt and the orchard-belt, more particularly in the triangle formed by Bunbury, Cranbrook, and Gingin. *Whaling* stations established at Point Cloates (near Onslow) and at Albany have revived a bygone industry. More important are the *pearling* grounds (*a*) in Shark Bay, with a centre at Denham, (*b*) along the coast from North-west Cape to Derby, with a centre at Broome. In 1922 221 small vessels and 1571 men were employed, most of them Japanese.

Northern Territory.—*Area*: 523,620 sq. m. (426,320 tropical, 97,300 temperate); arid area (rainfall under 10 inches) about 140,000 sq. m. *Population* (1921): 3867 whites, 17,349 aborigines. *Chief Town*: Darwin (1398). *Stock* (1922): cattle, 760,766; sheep, 6161. *Chief Products*: pearls and pearl-shell (1921-2), £1106 in value; gold (1921-2), 115 fine oz.; tin (1921-2), 79 tons. *Railways* (1921-2): 199 miles. For statistics of stock, products, etc., not given here see separate articles on Horses, Sheep, etc. A map is given on p. 511.

Topography.—The north-central division of the Commonwealth is geographically a portion of the western peneplain. It has therefore all the characteristics of tropical Western Australia, save that the useless arid portion is much smaller in extent. Speaking generally, the northern half lies between the 500- and 1000-ft. contour, while the southern half is mostly over 1000 feet in elevation. There is only one important mountain area, but this is one of the most definite series of ranges in Australia. The Macdonnell Ranges extend along the tropic as a series of parallel ridges culminating in Mount Heughlin (4800 feet). The main range is built of metamorphic rocks, but the southern units (Krichauff, Levi, etc.) are formed of folded Palaeozoic quartzites, etc. The Davenport Ranges (south-east of Tennant's Creek), rising about 1000 feet above the general level, are relics of a tableland dissected by the Frew, Gosse, and other rivers. In the extreme north of the Territory the Arnhem tableland is of much the same nature, but has not yet been properly explored. The well-known Barkly tableland in the north-east nowhere rises much above 1000 feet, and is merely the edge of the peneplain mentioned previously. The country as a whole is undulating and sparsely covered with timber. Eucalypts predominate in the wetter coastal regions, forming savannah-forest country or treeless savannahs, which are well-grassed in favourable years. In the interior and drier areas acacias are plentiful, especially the mulga. In the south, where they are more abundant, the saltbushes form a valuable herbage.

Hydrography.—The coast, except in the Gulf of Carpentaria, is much indented by inlets generally determined by Tertiary subsidence, which has drowned many river-mouths. It is little frequented, and there are practically no settlements except at Darwin itself.

The Victoria River, which enters the sea at the north-western corner of the Territory, penetrates farther into the Australian continent than any other known river on the north coast. Small craft can ascend it for 100 miles. The next important inlet is Anson Bay, where the Daly River enters the sea. It is usually navigable for 70 miles by vessels drawing six feet, but during the wet season the river is like a mountain torrent, and unnavigable. Port Darwin is an important harbour, a port of call for boats from Queensland to China, Singapore, Java, and India, and the terminus of cables to Java and to Singapore.

Two large islands (Melville and Bathurst) shut off Van Diemen's Gulf from the Timor Sea. The former, 75 miles long, is inhabited by a fine type of aboriginal. Many Indian buffaloes graze on the island. To the east of these islands is Coburg Peninsula, on which are the ruins of Port Essington; thence eastwards the coast is almost unvisited (save by trepang hunters) as far as the mouth of the Roper in the Gulf of Carpentaria. The aborigines are hostile, exploring parties through Arnhem Land have found no indications of valuable ores, and the district is not very encouraging from a pastoral point of view. Cape Arnhem, the north-east point, is just north of Caledon Bay. The sterile Groote Eylandt, about 36

miles long and 520 feet high near its centre, lies in the Gulf just north of the Roper entrance. The Roper River enters at the corner of the Gulf. It is a very fine stream, somewhat blocked by shallows at the mouth, but penetrable for 90 miles by vessels drawing 14 feet. The McArthur River enters the Gulf near Sir Edward Pellew's Islands; on one of these it is proposed to build a port, whence a railway will run to tap the Barkly region in the hinterland. Some 40 miles up the river is Borroloola, one of the chief settlements outside Darwin. The coast along all this portion of the Gulf is low, and the water shallow, indicating a general movement of elevation.

As in Western Australia, so in the Territory, there are several shallow inland basins. To the west of Powell's Creek (which lies on the low divide) is an indefinite area called Lake Woods, into which enter the intermittent creeks Newcastle Waters, Winnecke River, etc. On the eastern side Lake de Burgh receives the Creswell, Playford, Gosse, and Frew Rivers. Between the Macdonnells and the Musgrave Ranges to the south lies the large salt lake named Amadeus. Some doubt exists as to its level, which is probably about 1670 feet above sea-level. It receives no definite rivers, and is a mere expanse of salt 90 miles long and 15 wide. The Finke and other rivers running towards the NW. corner of Lake Eyre rise in the Macdonnells. They are a very important economic factor; they cut abruptly across the parallel ranges, excavating deep narrow gaps that contain numerous permanent rock-pools, and will lend themselves readily to dams in the future. The Palmer, the Hugh, and the Todd are the chief tributaries of the Finke. Only in heavy flood does the Finke reach the Macumba and enter Lake Eyre.

From north to south there is considerable variation in rainfall, ranging from 60 inches to six inches per annum at Charlotte Waters. It is entirely a summer rain, and this makes for a more uniform type of flora than the diversity in amount would suggest. Even in the north there are no rain-forests, while in the south (including the sand-ridge country) there are always numerous mulga trees. Next to the rainfall, the chief influence on vegetation is the varying composition of the soil. In the north the Cambrian limestone soils carry good feed and finer trees than do the Cambrian quartzites or Carboniferous sandstones. In the south the sandy formations are more useful than the clay-pan country that often alternates with them. On the whole the soils are rather sterile, and basic lavas—which do so much to enrich the soil in the east and south—are almost wanting. Thick coatings of laterite and travertine have been 'sweated out' by the hot sun, and cover the surface, as in most dry tropical countries.

The country has been opened up for 40 years, and its capabilities are now fairly well known. The most attractive portions (i.e. those containing natural permanent waters in the form of extensive waterholes, as on the upper Roper and Frew rivers) have been taken up many years since.

Population.—Of the four thousand people in the Territory, half are collected at Darwin and on the mining fields round Pine Creek. The other chief districts with their population are Barkly tableland (about 400), Alice Springs (about 400), Victoria River (about 200), and along the overland telegraph line (about 200). The remaining 1500 people are scattered over half a million square miles—probably the sparsest white population in the British Empire.

Products.—The most important industry is the grazing of *cattle,* which are chiefly carried on a belt that includes the Victoria River basin and the Barkly tableland. This belt receives about 20 inches per year, which accounts for extensive, well-grassed prairies between the arid mulga country on the south and the ranker vegetation of the north. The Victoria River district has about 300,000 cattle, and the Barkly tableland about 150,000. The chief stations on the tableland are Austral Downs, Avon Downs, Alexandra, Alroy, and Corella Downs. Along the overland line there are a few smaller stations, and about a dozen in the southern highland district, along the head-waters of the Finke River and its tributaries.

In 1914 there were about 600 *miners* in the Territory, of whom three-quarters were Chinese 'fossickers.' In 1921 there were only 340, about half of them white. Round Pine Creek are the Brock Creek gold-mines and the tin-mines of Mount Wells, Mount Todd, and Umbrawarra. Wolfram comes from Yenberrie and Wolfram Camp, and some copper is obtained on the Daly River. The whole industry is, however, languishing. At Tanami (near the western border) is a goldfield severely handicapped by distance and lack of permanent water. Arltunga near Alice Springs has produced much gold, and some mica occurs in the vicinity. Experiments connected with stock and agriculture are being carried out by the government at Darwin, on the Daly, and at Mataranka at the head of the Roper River.

The earliest industry was the collecting of trepang (bêche-de-mer) by the Malays. This animal (one of the starfish family) for 1921-2 yielded £2049. Tortoise-shell is also obtained in the coastal waters. Pearl-shell abounds, but the heavy tides render it a difficult product to win. Some 28 men are employed in the industry.

South Australia.—*Area*: 380,070 sq. m. (all temperate). *Rainfall*: Over 10 inches, 62,470 sq. m.; under 10 inches, 317,600 sq. m. *Population* (1921): 495,160 whites, 1609 aborigines. *Chief Towns* (1921): Adelaide (260,542), Port Pirie (9801), Mount Gambier (3969), Wallaroo (3308), Gawler (1775), Moonta (1335). *Stock* (1922-3): cattle, 425,811; sheep, 6,305,133. *Chief Products*: wheat (1922-3), 28,784,767 bushels; wine (1922-3), 8,653,579 gallons; gold (1922), 1000 fine oz.; iron ore (1922), 51,423 tons; copper (1922), 1185 tons; salt (1922), 48,657 tons. *Railways* (1921-2): 3487 miles. For statistics of stock, products, etc., not given here see separate articles on Horses, Sheep, etc.

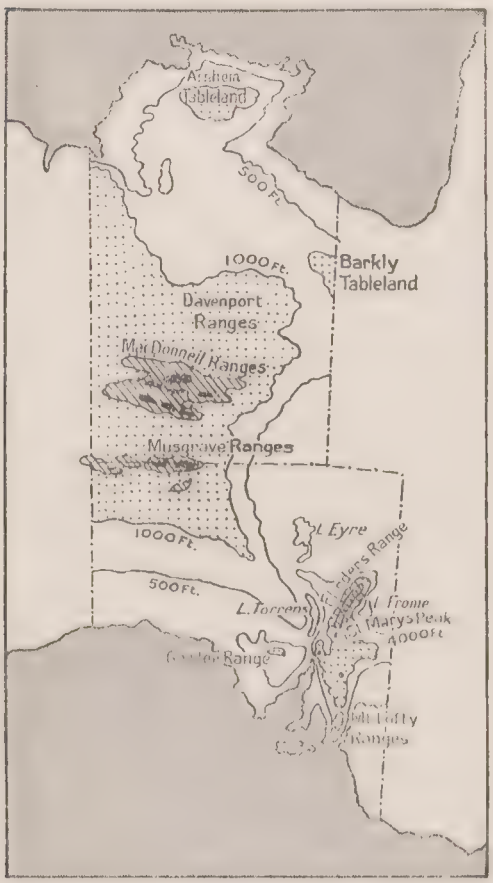
Topography.—Although much smaller than the two regions already considered, this State exhibits greater diversity in its topography. In the west it is an important segment of the western peneplain. In the north-east is the inland depression of Lake Eyre, the normal shore-line of which is 39 feet below sea-level. In the centre and south is the Torrens Rift valley, flanked by that striking topographic unit the Flinders Range. In the south-east are low-lying plains beyond the lower Murray. The highest point is Mount Woodruffe (possibly 5000 feet) in the Musgrave Ranges, which run E. and W., far from any settlement, along the northern boundary of the State. They are broad residuals above the old peneplain. The country slopes very gently from them down to

OROGRAPHICAL MAP OF
AUSTRALIA
Scale of Statute Miles
0 50 100 200 300 400 500
TIMOR SEA
From Banyuwangie (Java)
Submarine Cables
Melville I.
Bathurst I.
DARWIN
C Londonderry
CAMBRIDGE GULF
QUEENS CHANNEL
ADMIRALTY GULF
YORK SOUND
COLLIER BAY
KING SOUND
C Leveque
Wyndham
KIMBERLEY DISTRICT
Derby
Broome
ROEBUCK BAY
NINETY MILE BEACH
Salt Sea
Condon
Port Hedland
Cossack
Roebourne
Marble Bar
Monte Bello Is.
Barrow I.
EXMOUTH GULF
Onslow
N. W. Cape
L. Dora
L. Macdonald
LAKE AMADEUS
TROPIC OF CAPRICORN
WESTERN AUSTRALIA
INDIAN OCEAN
C. Cuvier
Barrier I.
Dorre I.
Dirk Hartogs I.
Carnarvon
Gladstone
Peak Hill
L. Wells
Nannine
Cue
L. Austin
Mt. Magnet
Lawiers
Laverton
L. Carey
Leonora
Northampton
Yalgoo
L. Barlee
SALT LAKES
HOUTMAN ABROLHOS
Geraldton
Dongara
Mingenew
L. Moore
Menzies
Queen Victoria Springs
Kalgoorlie
Coolgardie
Southern Cross
L. Lefroy
L. Cowan
Norseman
Eucla
Submarine Cable
From South Africa and Cocos Is.
PERTH
Fremantle
Northam
Beverley
Dundas
GREAT AUSTRALIAN BIGHT
Narrogin
GEOGRAPHE BAY
Bunbury
Collie
Katanning
Hopetoun
Esperance
ISRAELITE BAY
C. Arid
Busselton
Bridgetown
Denmark
Albany
C. Leeuwin
FLINDERS BAY
DOUBTFUL I. BAY
ESPERANCE BAY
KING GEORGES SOUND
SOUTHERN OCEAN
4000 FEET
3000 ,,
2000 ,,
1000 ,,
500 ,,
SEA LEVEL

135
F
140
G
145
H
150
J
10
a
15
b
20
c
25
d
30
35
f
155
160
TORRES STRAIT
Thursday I.
Cape York
C. Wessel
Wessels Is.
MELVILLE BAY
C Arnhem
Raine I
Cape Grenville
GULF OF
CARPENTARIA
Duyfhen Pt.
Cape Direction
Groote I.
Cape Keerweer
CAPE YORK PENINSULA
PRINCESS CHARLOTTE BAY
Cape Melville
CORAL
SEA
LIMMEN BIGHT
Sir Ed. Pellews Group
WELLESLEY ISLANDS
Borroloola
Cape Flattery
Cooktown
Port Douglass
Cape Grafton
Burketown
Normanton
Croydon
Georgetown
Herberton
Innisfail
ROCKINGHAM BAY
Hinchinbrook Island
PALM ISLES
HALIFAX BAY
Townsville
Cape Bowling Green
Charters Towers
Camooweal
Cloncurry
Richmond
Hughenden
Bowen
PORT DENISON
CUMBERLAND ISLES
REPULSE BAY
Mackay
Winton
NORTHUMBERLAND ISLES
BROAD SOUND
Boulia
Longreach
Barcaldine
Emerald
Clermont
Cape Manifold
Rockhampton
KEPPEL BAY
TROPIC OF CAPRICORN
PORT CURTIS
Gladstone
Bedourie
Springsure
Blackall
Tambo
Jundah
THOMSON
DIAMANTINA
Birdsville
Beetoota
Windorah
Tel. Stn.
Lady Elliot I
Sandy Cape
Fraser or Great Sandy I.
Submarine Cable to New Caledonia
Bundaberg
Maryborough
WIDE BAY
Double Island Pt.
Gympie
Adavale
Augathella
Charleville
Mitchell
Roma
Chinchilla
Bromanga
Thargomindah
Innamincka
LAKE EYRE
Lake Blanche
Bulloo L.
Eulo
Cunnamulla
St. George
Toowoomba
Cape Moreton
BRISBANE
MORETON BAY
Warwick
Goondiwindi
Point Danger
Submarine Cable to N. Zealand and Fiji
BYRON BAY
Lismore
Tenterfield
Marree
Hungerford
Wanaaring
Milperinka
Goodooga
Collarenebri
Brewarrina
Walgett
Moree
Bourke
White Cliffs
LAKE FROME
LAKE TORRENS
Beltana
Island Lagoon
Hawker
Port Augusta
Cockburn
Broken Hill
Wilcannia
DARLING
Cobar
Nyngan
Warren
Narrabri
Inverell
Glen Innes
Grafton
CLARENCE RIVER
Gunnedah
Coonamble
Armidale
Bellingen
Smoky Cape
Kempsey
Tamworth
Port Macquarie
Menindie
NEW SOUTH WALES
Nymagee
Dubbo
Wellington
Mudgee
Singleton
Cape Hawke
Maitland
Newcastle
Peterborough
Port Pirie
Wallaroo
SPENCERS GULF
Mossgiel
Condobolin
Parkes
Orange
Bathurst
BROKEN BAY
SYDNEY
PORT JACKSON
Morgan
Renmark
Wentworth
Hillston
Forbes
Wyalong
Cowra
Young
ADELAIDE
Angaston
Mildura
Balranald
LACHLAN
Hay
Temora
Goulburn
Wollongong
Kiama
Nowra
JERVIS BAY
Murray Bridge
Swan Hill
Narrandera
Wagga
Jerilderie
Deniliquin
Kerang
MURRAY
Yass
Gundagai
CANBERRA
Ulladulla
Duplicate Sub-marine cables to New Zealand
Goolwa
Serviceton
Echuca
Benalla
Albury
Beechworth
BATEMAN'S BAY
Moruya
Cooma
Bega
Montague I
Kingston
Horsham
Stawell
Bendigo
Beachport
Mt. Gambier
Hamilton
Ararat
Ballarat
Castlemaine
Kilmore Junc.
MELBOURNE
Omeo
Geelong
Bairnsdale
Sale
Bombala
Eden
TWOFOLD BAY
Cape Howe
Gabo I.
TASMAN
SEA
Portland
C. Nelson
Warrnambool
Camperdown
Colac
Cape Otway
NINETY MILE BEACH
CORNER INLET
Wilson's Promontory
BASS STRAIT
SOUTH PACIFIC OCEAN
H.E.C Robinson Ltd Sydney (Copyright)

the coast, and not until the transcontinental railway is reached are there any habitations; but here, and also close to the coast along the telegraph line, are a few sheep-stations.

There are two other groups of highlands—the Gawler Range, granite bosses rising five or



six hundred feet above the surrounding country, and the Flinders Range. The latter runs almost N. and S.—i.e. across the trend of the Macdonnell, Musgrave, and Gawler ranges—for 400 miles, and rises almost to 4000 feet in St. Mary's Peak near Edieowie; Benbonyatha in the north and Mount Remarkable near Port Augusta are well over 3000 feet. A broad, low extension stretches towards Broken Hill, and south of this rises to 2835 feet in Mount Razorback near Kooringa. The southern portion, known as the Mount Lofty ranges (2334 feet), lies behind Adelaide.

The plains in the north-east and south-east are best considered in connection with the rivers.

Hydrography—Coasts.—The State has a much-indented coast-line, consequent on relatively recent subsidences of the crust. The Adelaide district, in fact, is still subject to seismic shocks of considerable intensity. Since almost all the population—as will appear later—is confined to the coastal regions, they are here described rather fully.

There are three broad divisions; the smooth coast of the Bight, the three peninsulas (Eyre, Yorke, and Fleurieu), and the smooth south-eastern coast. There are no landing-places in the cliff-bound coast from Eucla to Fowler Bay. At the head of the Bight the cliffs are lower than to the west, but westerly winds drive heavy seas against the lee shore to eastward. The small settlement of Port Eyre (Yatala) lies in the sheltered anchorage of Fowler Bay. Nuyts' Archipelago fringes the coast to the east. At the southern corner of Streaky Bay the township of Flinders has a jetty and light. On Eyre's Peninsula there are on the west Anxious Bay (Parkin) and Coffin's Bay (Wangary), and on the east an important harbour, Port Lincoln, which has been used as a naval training station. Port Lincoln is said to be the finest harbour in South Australia. Being a railway terminus, it collects wool and wheat from the Peninsula; there is a long jetty and a light, and steamers call regularly from Adelaide. The coast to the northward is low; Tumby Bay, and Cowell on Franklin Harbour, are the chief settlements until False Bay is reached. Here a railway to Iron Knob brings iron ore to the coast, where it is shipped across Spencer Gulf to Port Pirie. At the head of the gulf is Port Augusta, the terminus of the federal railway to Western Australia; it has fine wharfing accommodation and three jetties. Wheat, copper, wool, and hides are exported. To the north the gulf, much narrowed, extends somewhat indefinitely, and gradually merges into a salty swamp over 20 miles long.

Proceeding down the east coast of the Gulf, we pass notoworthy ports at Port Germein, Port Pirie, and Port Broughton. At Port Pirie are large smelting works, connected directly by rail without break of gauge to Broken Hill. Vessels drawing 20 feet can discharge here. Over 12,000 people live in the district, which grows much wheat. At the northern end of Yorke Peninsula are the copper towns of Wallaroo and Moonta. Both have large smelting works, and are connected with Adelaide by rail and steamer. The remainder of the peninsula is chiefly agricultural. It ends in Cape Spencer, off which a powerful light is situated on Althorpe Island.

St. Vincent Gulf lies between Yorke and Fleurieu peninsulas. It is bounded on the south by Kangaroo Island, and can be entered by the wide Investigator Strait from the south-west, or by Backstairs Passage from the south-east. There is little settlement along the south coast of Yorke Peninsula, but Edithburg is a small township just N. of Cape Troubridge. A light visible 15 miles is placed on Troubridge shoal. Low cliffs occur most of the way to the head of the gulf. There are small settlements at Stansbury, Port Vincent, Ardrossan, etc., chiefly exporting wool and wheat, and acting as watering-places for Adelaide. Port Wakefield at the head of the gulf is on the rail from Moonta to Adelaide. Wool and wheat are its chief interests. Low swampy coasts bring us to Port Gawler (of little importance), and then the entrance to Port Adelaide is reached. Here huge engineering works have produced a fine outer harbour, where ships of 18,500 tons can berth, as the depth of water throughout is 33 feet. The wharf, over half a mile long, is connected by rail with Adelaide. A sandy tongue of land (Lefevre's Peninsula) separates Port Adelaide (nine miles up the Torrens River) from the sea. Largs and Semaphore, on this tongue of land, have wharves projecting into Largs Bay. The capital is situated inland, some six miles from the coast and ten miles south-east of Largs Bay. Henley Beach, Glenelg, and Brighton are watering-places south of Largs

Bay. A low rocky coast leads south to the small port of Noarlunga at the mouth of the Onkaparinga River. Aldinga and Yankalilla are small settlements to the north of Cape Jervis.

Kangaroo Island is 80 miles long and 24 miles wide. It is for the most part low-lying, the summit (in the south-west) being only 700 feet. The settled area lies chiefly in the north-east, at Kingscote and Hog Bay. A telegraph runs to Cape Borda at the western end, where there is an important lighthouse and signal-station. The island is largely covered with are mallee, but much barley and wheat are grown in the north-east. Steamers from Port Adelaide call regularly at Kingscote.

Eastward of Cape Jervis extends a bold granite coast until the three small towns of Port Victor, Port Elliot and Goolwa are reached —the last an important port situated within the Murray mouth. Our largest river enters the sea by a narrow opening in the beach, across which the surf usually breaks heavily, so that it is only used by vessels of light draught. The mouth shifts eastward as the sand-dunes drift before the prevailing wind, and the bar is only about 10 feet below the surface at high tide. Within the mouth are three openings leading into Lake Alexandrina, 20 miles long and about 10 miles wide; a smaller expanse, Lake Albert, joins it on the south-east. South of the mouth extends for 90 miles an unbroken sandy coast, flanking the lagoons that form the Coorong. Lacepede Bay (with Kingston) forms its southern limit, from which a railway traverses wheat country to Naracoorte and the main line. At Cape Jaffa are a light and a signal station. Robe, Beachport, and Grey Town on Rivoli Bay, and Port MacDonnell (with a lighthouse on Cape Northumberland), are small ports in the extreme south-east.

Rivers and Lakes.—As a whole the State is poorly watered. The rivers fall into three groups —(1) those flowing into Lake Eyre; (2) those draining the Flinders Range; (3) the Murray. North-west of Lake Eyre are the Macumba (receiving the Finke, Stevenson and Alberg) and the Neales; all these, except the Finke, rise in the Musgrave and Everard ranges. Their channels are usually long stretches of white sand, apparently dry; but the occasional transverse rock-bars have water flowing over them, so that under the white sand also there must be water. Heavy downpours, of course, will produce a visible stream, which lasts until the natural absorption of the sandy bed can account for the whole inflow. The eastern side of Lake Eyre is a vast alluvial delta, into which flow the Diamantina and Cooper's Creek. Distributaries are numerous, the chief being the Strzelecki, which supplies the chain of lakes from Frome to Gregory. All these lakes are within a few feet of sea-level, and Lake Eyre is from 39 to 60 feet below it. The lake covers about 3700 square miles, and if filled up to sea-level would only be enlarged to 5000 square miles; the suggestion that great economic results would follow its connection by canal with the sea is a pure chimera. In 1921 Gerald Halligan skirted it by air-plane. In times of heavy rainfall many square miles of this country are flooded. Lake Torrens, 130 miles long, and Lake Gairdner, 90 miles long, are merely saline mud-flats of no economic importance.

None of the rivers draining the Flinders Range are of any size. The Frome runs for 150 miles NNW. into the southern end of Lake Eyre. Willochra Creek runs N. from Mount Remarkable to the south-eastern corner of Lake Torrens; it is about 80 miles long, but only flows throughout in flood-time. The Broughton, Wakefield, Light, Torrens, and Onkaparinga are similar but shorter streams along the western flank of the ranges. On the eastern side the Siccus (Pasmore), which enters Lake Frome, occupies what seems to be the bed of a large river which in pre-uplift days (before the Flinders Range developed) flowed south to the gulfs. The chief importance of these rivers is as water-suppliers. Thus reservoirs in the Torrens and Onkaparinga valleys supply Adelaide; those at Beetaloo and Bundaleer supply Wallaroo, Moonta, and 34 other neighbouring townships; that at Barossa (supplied from the South Para) furnishes water to 23 townships in the Gawler district.

The lower Murray runs for about 250 miles (including meanders, 500) through South Australia. Along this distance it receives no tributaries of note, but flows between high banks cut in the soft sediments of the old Tertiary sea, and makes several abrupt bends, notably at Morgan. Since railways have tapped the river-towns steamer traffic has greatly decreased; the river is, however, of increasing importance as regards irrigation. Thus Renmark (3000) is entirely supported by the dried fruit industry, which for the period 1911-21 averaged 40,619 cwt. of raisins and 54,698 cwt. of currants annually; the dried fruit pack for 1923 amounted to 2750 tons, including currants, 1000 tons; sultanas, 975 tons; lexias, 520 tons. Many small settlements fringe the river, e.g. Berri, Pyap, Moorook, Holder and Waikerie above Morgan. The rich swamp-lands below Mannum, when properly drained and cultivated, yield enormous crops.

Artesian Water.—South Australia is fairly well-favoured in this respect. The NE. quarter, where the rainfall is only five or six inches per year, includes a considerable portion of the Great Artesian Basin, whose boundary practically coincides with the railway from Marree to Oodnadatta. Mound springs, where the excess water overflows naturally, are common SW. of Lake Eyre. Coorie Creek (1370 feet deep, east of Lake Frome), Raspberry (416 feet, near Oodnadatta) and Dulkaninna (2226 feet, on the Diamantina) are bores with flows of 1,000,000 gallons per day, and most of the nine bores on the stock-route from Marree to Birdsville exceed 400,000 gallons per day. The south-eastern part of the State is part of the Murray River Tertiary basin, which is largely fed by water falling in the Wimmera district of Victoria. In these bores the water is sub-artesian, and does not rise to the surface; they are usually less than 300 feet deep, and the water is good, especially in the south. It is probable that the beautiful lakes associated with extinct volcanoes near Gambierton are supplied largely from this artesian basin.

The area near Millicent has been rendered much more fertile by a system of widespread drains, costing half a million sterling, which serve to remove excess ground-water from the extensive swamps, and so to convert them into valuable agricultural areas. The Eucla artesian basin has not furnished important supplies, though stock are watered from bores in the Nullarbor Plains. Small basins near Adelaide and Willochra have been extensively tapped.

Population.—The centralization of population in this State is striking; 52½ per cent of the whole people live in the capital city. By drawing isopleth contours for the State it can be

shown that the population has spread from Adelaide north and north-west, so that the next two isopleths include Kapunda and Port Pirie respectively; the next zone (4-8 per sq. m.) includes Port Augusta, Petersburg, Morgan, and the lower Murray. Of the same rank is the first outlying settlement, that of Mount Gambier in the far south. The next zone (1-2 per sq. m.) includes Port Lincoln and the wheat-lands round Pinnaroo. A belt along the coast to Fowler's Bay, including the other zones, defines the area known as 'the counties.' The rest of the State is not so subdivided, its population being only 4000 (or 1 person to each 75 sq. m.); it is obvious, therefore, that the economic importance of the State is largely confined to 'the counties.'

Products.—Sheep are much more important than cattle in this State, but are steadily decreasing in number, for there were twice as many in 1890 as in 1815. They occur most abundantly in the south-east round Gambierton, and between Port Pirie and Cape Jervis; these two small districts include nearly half the total. The next important zone includes the area along the Broken Hill railway; Eyre's Peninsula (NW. of Port Lincoln) is also important sheep country. Only about one-sixth of the total live beyond the counties in the purely pastoral region. In the north-western corner there are no stations, the outlying flocks being on the Alberga.

Cattle are relatively of small importance. All the other States except Tasmania have larger herds, and the number has not varied much since 1890. They are confined almost entirely to the Flinders highlands and to the Gambier district. Dairy herds occur chiefly in the Adelaide region (from Gawler southward) and round Mount Gambier. But among the copper towns, as also in Eyre's Peninsula, there are important dairying districts. Only a quarter of the cattle are grazed in the huge area beyond the counties, chiefly in the north-east and near the railway to Oodnadatta.

The State is pre-eminent in *wheat-growing*. It ranks third of the Australian States in total production, but produces twice as much per head as New South Wales (the leading State). The rainfall control is absolute. The extreme boundary of the wheat-growing area appears to be the 6-inch winter isohyet (April-October), which runs approximately parallel to the 10-inch annual isohyet and about 25 miles outside it. This limit is beyond Goyder's well-known line, which was based on the native flora, and was, indeed, within the 10-inch wheat-rainfall line. However, no wheat-crops of importance are grown north of the 10-inch annual rainfall line.

The five counties north of Adelaide are the chief producers, Wallaroo being perhaps the centre of the heavy wheat-crops. But almost all the area between Port Augusta and Wolseley on the Victorian border is devoted to wheat, as is the eastern coast of Eyre's Peninsula. The greatest development has taken place in the erstwhile useless mallee plains south of the Murray, round Pinnaroo. Many miles of railway lead from Tailem Bend to irrigation settlements such as Waikerie, Loxton, and Renmark, or through new wheat-centres like Karoonda, Alawoona, Parrakie, Pinnaroo, Gurrai, and Peebinga. In Eyre's Peninsula similar new lines lead from Port Lincoln northward through fresh wheat country to Darke's Peak and Kimba, and westward via Yeelanna and Minnipa to Ceduna, 269 miles away, on the coast at Denial Bay.

Eighty-four per cent of the *wine* comes from the counties of Adelaide and Light, i.e. the area south of Kooringa; Angaston, Tanunda, Clare, Lobethal, and Truro are centres of viticulture. Grapes are also grown at Renmark on the Murray and in the Gambier district. The hill-slopes of the southern Flinders Range and of Mount Lofty seem particularly suitable for this industry, receiving a total rainfall of about 20 inches, most of which falls in winter. These conditions closely resemble those obtaining in the Mediterranean countries that are the chief centres of the wine trade.

The State is poorly provided with *forests*, but the forestry department is doing good work to remedy this shortage. There is practically no timber industry, only 1,187,000 super feet being cut in 1922-3. The Mount Lofty ranges, with a 20-inch rainfall, are fairly well wooded with stringy-bark, blue gum, manna gum, and peppermint; the ubiquitous red gum is found in the valleys. Within the 15-inch isohyet the vegetation belongs to the 'Savannah forest' type, where grass replaces the bushy undergrowth of the better watered regions. The eucalypts grow farther apart, but on the whole belong to the same species.

Copper is the most important metal. Formerly the four mining-fields of Kapunda, Burra, Wallaroo, and Moonta easily placed South Australia at the head of the list in copper production, but the two first named are of little importance now. Wallaroo and Moonta have produced copper worth 13 millions sterling, and are still very important producers. Many smaller mines are scattered through the ancient rocks of the Flinders Range, perhaps the chief being at Blinman. *Gold* has never been of much importance. Barossa, 30 miles north of Adelaide, and Teetulpa on the Broken Hill line have yielded the most, but Tarcoola on the transcontinental railway is the chief field of late years. From Iron Knob, 40 miles SW. of Port Augusta, about 1,000,000 tons of *iron* ore have been shipped to Port Pirie as fluxes for the Broken Hill ores. In 1920 about half a million tons were sent to Newcastle, and smelted there at the Broken Hill Proprietary Co.'s works.

Near Edithburg on Yorke Peninsula is Lake Fowler, a shallow expanse from which half a million tons of crude *salt* have been scraped. At Lake Hart, 120 miles NW. of Port Augusta on the transcontinental line, there is another deposit of large extent.

The East-west Railway.—The transcontinental railway, which was completed in November 1917, runs from Kalgoorlie for 1060 miles to Port Augusta, and links Western Australia to the eastern States. The gauge is 4 feet 8½ inches, and to it in the end all other inter-State lines will be standardized. It serves an area of about 90,000 square miles, which may be considered favourable for pastoral development. Possibly the western portion will ultimately grow 'dry' wheats, for the rainfall (though below 10 inches) falls regularly in the vital months.

The region traversed comprises a higher western portion (extending about 160 miles E. of Kalgoorlie), which consists of ancient greenstones, granites, etc., and an area of Tertiary limestones, which extend at a level of about 500 feet most of the way to South Australia. Inferior water is obtainable here from bores. Near Tarcoola in South Australia mineralized rocks crop out again. Outlying sheep and cattle

stations are situated at Wilgena and Coondambo, while there may be a future for the salt deposits at Lake Hart. The chief asset, however, is the saving of time in communication with Western Australia and Europe; the railway is also important from a military point of view.

QUEENSLAND.—*Area*: 670,500 sq. m. (359,000 tropical; 311,500 temperate). *Rainfall*: all above 10 inches, except 91,012 sq. m. almost all in temperate portion). *Population* (1921): 755,972 whites, 12,614 aborigines. *Chief Towns* (1921): Brisbane (217,714), Rockhampton (24,168), Townsville (21,353), Toowoomba (20,676), Ipswich (20,517), Maryborough (10,629), Charters Towers (9489), Bundaberg (9276), Cairns (7464), Mount Morgan (7220), Gympie (6537), Mackay (6313), Warwick (6091). *Stock* (1922): horses, 713,015; cattle, 6,955,463; sheep, 17,641,071. *Chief Products*: wheat 1922-3), 1,877,836 bushels; wool (1922), 134,971,150 lb.; maize (1922-3), 3,217,848 bushels; sugar (1922-3), 287,785 tons; cotton, unginned, (1922-3), 3,956,635 lb.; bananas (1922-3), 1,618,848 bushels; butter (1922), 53,785,599 lb.; cheese (1922), 10,560,316 lb.; milk (1922), 134,031,830 gallons; timber (1922) 126,088,000 super feet; pearls and pearl-shell (1922), over £125,000 in value; gold (1922), 80,584 fine oz.; silver (1922), 273,036 fine oz.; copper (1922), 5104 tons; tin (1922), 1094 tons; coal (1922), 958,519 tons. *Railways* (1921-2): 7064 miles. For statistics of stock, products, etc., not given here see separate articles on HORSES, SHEEP, etc.

Topography.—In this State we first meet with typical east-coast topography; the highlands are situated along the littoral, and the lowland plains are found in the west. In the physiographic section it will be shown that a great portion of eastern Australia has foundered beneath the Pacific, and the present coast-line is not far removed from the old divide. Speaking generally, the eastern plains are small, bordering the lower courses of the chief rivers; a belt of highlands often rises abruptly from the sea, and slopes gradually to the west. From Cape York to the South Australian border there is a great lowland area; the Gulf of Carpentaria is the drowned western portion of this lowland, and all the western side of the Cape York Peninsula is very low. An inlier of ancient rocks near Camooweal is connected with the highland region by the Kynuna uplands, but in a direct line from Cape York to Melbourne there is practically nothing above 1000 feet except three miles at the Kilmore gap in Victoria.

The most striking feature in Queensland topography is the Atherton plateau in latitude 18° S. This is a triangular area of about 12,000 square miles, all over 2000 feet, and is bounded on the north-east by the Bellenden Ker Range, which rises to 5438 feet in Mount Bartle Frere. Only three other small districts rise above the 2000-ft. contour, so that Queensland is generally of very moderate elevation. There is a crescent of high land round the Bowen River behind Mackay, which includes the Clarke and Leichhardt ranges; the Buckland tableland, south of Springsure, is the second; and the Darling Downs (an offshoot from the Macpherson Range) form the third. Mount Roberts and Wilson's Peak, near the border of New South Wales, are 4000 feet high. All the rest of Queensland, including the numberless mountain ranges listed in school geographies, is (except for isolated peaks) below 2000 feet. This is true for the so-called 'main dividing range,' which is really composed of a series of basalt flows and minor warps or peneplain residuals. [Some day atlas-makers will realize that the 1000-ft. contour is infinitely preferable to the 'herring-bone' hachure, and then our main divide will be adequately represented.]

The various tributary 'ranges' are also largely residuals, left as divides by river-erosion. This is indicated by the prevalence of the nomenclature 'downs'—e.g. Peak Downs, east of Clermont; but fragments of an older series of granite and allied ranges occur along the coast—e.g. the D'Aguilar Range and the Glasshouse Mountains near Brisbane, the Dawes Range behind Bundaberg, the Normanby Range south of Broad Sound, and Mount Elliot (4000 feet) near Townsville. In the Peninsula are a few isolated highlands of little importance, all fringing the east coast. Elevated divides (rather than ranges) separate the western rivers. Thus the Grey Range separates the Bulloo from Cooper's Creek, and the Beal Range lies between that river and the Diamantina; but they are only important by contrast with the wide expanse of low-lying plains. The Selwyn highlands, south of Cloncurry, rise well above 1000 feet, and merge into the Barkly tableland on the borders of the Northern Territory.

Hydrography—Coasts.—The south coast of the Gulf of Carpentaria is very low and entirely fringed by mangroves. Approach is difficult, as the waters are very shallow. The Wellesley Islands rise to about 300 feet; Mornington Isle is 35 miles long. On Sweers Island was the now vanished settlement of Carnarvon. The Nicholson, Albert, and Leichhardt rivers discharge at the southern end; Burketown lies some 40 miles up the Albert. At the south-eastern corner are the mouths of the Flinders and Norman rivers. The latter river has a pilot station (Karumba) at its mouth, whence

small boats can reach Normanton, 45 miles inland.

The eastern shore of the Gulf is low, and formed of alluvial brought down by numerous rivers. There are a few cattle-stations on the higher land away from the coast, and mission stations near the mouth of the Mitchell, Archer, and Batavia rivers. The last is a fine stream, navigable for boats for 36 miles. The Gulf as a whole is very shallow—nowhere more than 43 fathoms.

Torres Straits are filled with small islands and coral-reefs. Prince of Wales Island, the largest, is 11 miles across. Thursday Island, much more important, is 374 feet high and about 1½ miles long; Port Kennedy on the south side is a port of call for vessels from Brisbane to London, India, Hong Kong, and Japan. Stocks of coal are held on it, and it is also the centre of the east-coast pearling trade. Cape York is a prominent landmark, a hill on it rising to 400 feet. Near the small settlement of Somerset, just to the east, the *Quetta* was wrecked with great loss of life in 1890. Apart from three lights (at Temple Bay, Cape Sidmouth, and Cape Melville) there is little of interest north of Cooktown. Two large bays (Shelburne and Princess Charlotte) occupy basins where the coast truncates the meridional ridges. At Cape Melville the continental shelf bearing the great coral-reef barrier is narrowest (12 miles), and a little south of it is Cook Passage, where vessels running between Cooktown and New Guinea traverse the reef. Southwards begins a series of remarkable capes, all really high and rocky islands, separated from the hinterland formerly by water, now by low plains—Capes Flattery, Bedford, Archer, Tribulation, and Grafton. Peterbotte is an isolated peak (3468 feet) behind Cape Tribulation.

Cooktown, the first settlement on this coast, ranks as the tenth port of the State. It has about 900 inhabitants, and a railway runs inland 67 miles to Laura near the Palmer goldfields. Here in 1770 Cook carcened his ship in the Endeavour River, after being wrecked on a coral-reef 30 miles to the south. Cairns, about 100 miles south, is the fifth port in the State as regards the number of ships entering it. Behind it the Barron River has cut a remarkable gorge in the scarp of the Atherton tableland, and the falls (600 feet) are the finest in Australia. The tableland is served by a railway from this port, and another connects it with Townsville. The heaviest rainfall in Australia (165 inches) falls at Harvey Creek, 30 miles south of Cairns. The whole coast south of Cooktown is mountainous. The grain of the land runs north and south, and the oblique coast, cutting across this, has produced a succession of rocky headlands and long, narrow bays. Innisfail, Cardwell, and Halifax, which lie at the foot of the great scarp, are centres of sugar districts. Hinchinbrook Island (3650 feet), separated from the mainland by a navigable channel about 20 miles long, is comparable with the land-tied islands noted previously, and with those bordering Whitsunday Passage farther south.

Townsville, the third town and second port in the State, lies on Cleveland Bay behind Magnetic Island. It is the terminus of a railway that serves a large part of northern Queensland, running inland to Cloncurry and Winton. Its exports total some two millions sterling. To the south the coast is lower; the Burdekin River, which enters Upstart Bay by several mouths, is only navigable for small boats and is infested with crocodiles. Ayr on the delta is connected by the coastal railway with Townsville to the north and Bowen and Proserpine to the south. Bowen, the next port (sixth in rank), serves an important pastoral region and a valuable coal-field on the Bowen River. Whitsunday Island, separated from the mainland by one of the most picturesque passages (30 miles long) along the Australian coast, lies halfway between Bowen and Mackay. Off the latter is a powerful light on Flat Top Island. Mackay is the centre of an important sugar district, and does a large coastal trade. Broad Sound (with St. Lawrence) and Shoalwater Bay are two north-pointing openings due to the drowning of the grain of the land. Almost on the tropic is Rockhampton, 35 miles up the Fitzroy, the second town and third port in the State, and the terminus of the central railway, which runs to Longreach and Blackall in important sheep country. The coastal railway which connects it with Brisbane is extended past it northwards to Townsville and Cairns. Copper, gold and coal, mines occur in the hinterland.

Gladstone and Bundaberg are the next two ports. Off the latter is Lady Elliot Island, the most southern coral islet of the Barrier Reef. Great Sandy Isle, 68 miles long, rises to 800 feet; a powerful lighthouse is placed on its northern extremity. Maryborough is 15 miles up the Mary River, which empties into Hervey Bay behind Great Sandy Island. It has a considerable coastal trade. Thence there are no important inlets or ports until Moreton Bay is reached, which is sheltered from the Pacific by Moreton and Stradbroke islands, each about 20 miles long. Brisbane, the capital city of the State, is situated 13 miles up the Brisbane River. It is by far the largest town in the State; 28 per cent of the whole population is concentrated here—a much smaller proportion than in the other large capitals. Southport is a watering-place on the coast to the south, not far from Point Danger, the boundary of the State.

Rivers.—Queensland is perhaps the best watered of all the States except Tasmania, because so large a portion of it lies in the region of fairly uniform rain. Few of its rivers, however, are of any importance for navigation. As we have seen, the grain of the land runs north and south, so that the coastal streams in general have to cross these ranges near their mouths. The Fitzroy, perhaps the principal river, is about 500 miles long, and has many large tributaries such as the Dawson, Mackenzie, and Isaacs, but above Rockhampton navigation is practically non-existent. The Burdekin, about 400 miles long, has a similar zig-zag course determined by the coastal ranges. The Suttor, Belyando, and Bowen are its principal tributaries. Both the Fitzroy and Burdekin appear originally to have been west-flowing rivers, but have been captured by coastal streams. The Brisbane River, about 200 miles long, rises on the Darling Downs and flows through a rich dairying and agricultural district. Coal-barges float down from Ipswich to the capital. The Mary and Burnett are smaller rivers between the Fitzroy and Brisbane. North of the Burdekin the highlands have been so abruptly truncated by the faulted coast that there is no room for large coastal rivers. Indeed, the Mitchell, which rises close to the Barron Falls on the east coast, flows thence westward to the Gulf.

The chief rivers flowing into the Gulf have been mentioned. Several important ones flow

south into Lake Eyre or the Darling. The principal tributary of the Darling is the Condamine, which drains the western slopes of the Darling Downs, then, with the Maranoa, forms the Balonne, and flows through rich pastoral country to split again into the Culgoa and Narran. The Warrego and Paroo, farther west, occasionally reach the Darling, but are usually lost in the vast alluvial beds of north-western New South Wales. The Barcoo and Thomson unite to form Cooper's Creek, and often send down huge floods into Lake Eyre. The Diamantina and Eyre, whose head-waters are in or near the Selwyn highlands, similarly join to form the Warburton, and more rarely reach Lake Eyre. All these inland rivers vary greatly in their flow, and for long periods are mere strings of waterholes; but in flood-time their lower waters may spread out 20 miles or more over the flat western plains.

Artesian Basin.—Queensland is specially favoured in that 56 per cent of the State (including her driest region) forms part of the chief artesian basin in the world. A line joining Normanton to Warwick roughly indicates the eastern boundary, and the whole region westwards, except the inlier of older rocks west of Cloncurry, forms part of the basin. The 1287 flowing bores vary greatly in depth and supply; the deepest are in the north centre of the basin, as at Bimerah, 100 miles SW. of Longreach, where the bore goes down 5045 feet (a bore 40 miles W. of Blackall, in the same area, goes down 7009 feet); many others over 4000 feet deep occur between Hughenden and Windorah. The temperature is often very high, as at Eldershe near Winton (200° F.). The largest flow comes from Millungera (100 miles NE. of Cloncurry), where it is said to total about five million gallons daily, and there are 152 bores giving over one million gallons each. The rapid increase in stock in western Queensland is largely to be credited to this supply, which amounts to 299 million gallons daily.

Population.—For the whole State the population is over one person per square mile, but the great majority of the inhabitants are clustered along the central and southern coast-line. Several regions merit special consideration. The capital and the lower Brisbane valley (including the Ipswich coal-field) are naturally the most closely settled. Apart from the elevated Downs country, they have naturally the coolest climate in the State. Rockhampton and its neighbour Mount Morgan form the second 'cluster,' which has similarly grown up at an important railway terminus supported by a valuable mining-field. Similar centres on a small scale occur at Gympie, Maryborough, Bundaberg, and Mackay. Townsville and Charters Towers form a somewhat isolated community in the north, and the Chillagoe mines, coupled with the rich agricultural district of the Atherton tableland, have led to a large settlement of whites within 18° of the Equator. Along the southern railway fairly close settlement has spread as far as Roma and Mitchell, with prosperous farming communities on the high land round Toowoomba.

North and west of a line joining Cooktown to Burketown and thence to Cunnamulla there is hardly any settlement. Probably only 15,000 people live in this area of approximately 190,000 square miles, or 1 to every 13 square miles. Some 3000 more are engaged in fishing and trading in the far north, with Thursday Island as a centre.

Products.—The most important industries are connected with *cattle;* Queensland contains about half of the Australian total. The chief cattle areas are south of the Gulf, round Townsville and Rockhampton, and in the southern corner. It is obvious, therefore, that they keep to the hotter, rougher and wetter regions, leaving the dry, open central plains for sheep. Dairying is making rapid progress, 563,683 of the cattle belonging to dairy herds. The south-eastern corner is naturally the most important in this respect, and contains nearly half the total. Maroochy, north of Brisbane, and Beaudesert to the south are especially concerned. Another quarter graze in the Wide Bay district, where Gympie is an important centre, and about the same number on the Darling Downs. Only four per cent are distributed elsewhere in Queensland.

The distribution of *sheep* in the State is very definitely arranged in a series of zones about Longreach. Sixty per cent are pastured in the province of Mitchell (round Longreach), Warrego (S.) and Maranoa (SE.). The next zone includes Burke (N.), Gregory (W.) and Darling Downs (SE.). The inland portions of the central and western railways serve the chief sheep regions, which are clustered round Longreach, Charleville, Cloncurry, Hughenden, Barcaldine, Cunnamulla, and St. George. The great majority are grazed on the grass-land and open forest country lying between the 10-inch and 30-inch isohyets. In good years the south-western corners of the State are occupied, but in bad droughts these stations are sometimes temporarily abandoned. With greater facilities for watering by means of dams and bores, and with better railway transport, sheep will be grazed in much greater numbers in the west and north-west.

Since the comparatively recent beds that form the Great Artesian Basin build up almost the whole of central and western Queensland, its *auriferous* areas are confined to the ancient rocks of the eastern highlands and of the Cloncurry inlier. The chief fields are near the east coast. Mount Morgan (near Rockhampton) was in 1922 by far the largest producer; Gympie was a bad second, and Charters Towers in the north a worse third. Two smaller fields at Etheridge and Croydon are situated on the edge of the artesian basin south-east of the Gulf; the Etheridge field (round Georgetown) is connected with the Cairns railway; the Croydon field is linked to Normanton on the Gulf.

Cloncurry and Mount Morgan are by far the chief producers of *copper.* In 1922 out of a total yield of 4984 tons Mount Morgan produced 4483 tons; the Cloncurry yield decreased from 7640 tons in 1920 to 325 tons in 1922. Etheridge, Herberton and Chillagoe are less important copper-fields.

Over 60 per cent of Queensland *coal* comes from the Ipswich seams. These are older than the artesian beds, and dip under their eastern edge. The Aberdare seam, in places 11 feet thick, is the chief. An immense seam of much older formation occurs at Blair Athol near Clermont; in 1922 104,141 tons were hewn here. The Atherton tableland, in addition to its gold and other metals, has a coal-field at Mount Mulligan; the output is small, but of great value in that isolated locality. The Dawson Valley field is being opened up at Baralaba.

In 1922, 1098 tons of *tin* were produced; Herberton contributed over half, and Kangaroo Hills was second in importance. Near Cooktown in the north and Stanthorpe in the south there

are valuable tin deposits. Three rarer metals—*molybdenum, wolfram,* and *bismuth*—are found in considerable quantities, especially in the Chillagoe district. *Sapphires* are found at Anakie (south of Clermont); over £35,000 worth were obtained there in 1922. Precious *opal* is the only mineral deposit in the artesian basin, a belt of opal-fields running across the west of the State from Kynuna through Opalton to Cunnamulla.

Forests of commercial value are confined to the eastern coast, where the annual rainfall is about 25 inches and fairly uniform. Two classes of forest occur; the 'vine scrubs,' the tropical rain-forest of the botanist, knotted together by vines and lianas, which contain many softwood timbers allied to Malayan types; and the valuable hardwood forests, containing various eucalypts like those in the temperate rain-forests of the south-east. Pines (*Agathis* and *Araucaria*), together with cedar, silky oak, native maple, native beech, etc., are the chief softwood timbers. They occur along the Atherton scarp from Cooktown nearly to Townsville, and smaller patches are found near Bowen and Mackay. From Gladstone southwards the two classes of forest are much mixed. There is a thick forest of this type between Gympie and the Darling Downs, and another along the Macpherson Range. Eucalypt forests are also scattered. There is a belt just along the inner edge of the vine scrubs behind Cairns; Clermont and the western side of the Dawson basin have good forests; and all the south-eastern corner, especially the Darling Downs and south coast region, has a plentiful supply of eucalypts. In other parts of the State eucalypts, though widespread, are for the most part short and poor in form.

Wheats grown in the southern States spread into the south-eastern corner of Queensland. The total crop is relatively small, for the centre of production is Warwick, almost on the border. Nanango (north of Toowoomba) is about the northern limit, while Mitchell and Roma are at the western boundary. It is probable that Indian types can be grown successfully on the tropic near Emerald and Tambo. The present crop grows where 10 to 15 inches of winter rain fall. The *maize* crop, as it is better suited to warm climates, is three times as large as the wheat; it is grown chiefly in the south-east, especially round Nanango and in the upper Brisbane valley. The Maryborough and Burnett valleys are also very productive. One of the chief centres is far to the north at Herberton on the Atherton tableland, but it is grown in small quantities all along the coast. *Bananas* are an important crop in several districts, notably near Brisbane and Maroochy on the south coast, and at Mourilyan and Cairns on the north coast.

For many years the *sugar* crop has been worth over a million pounds annually, the greatest amount of sugar (307,714 tons) being obtained in 1917-8. The cane is confined entirely to the well-watered coastal alluvials, where the rainfall is in general over 60 inches a year. Mackay grows one quarter of the whole; Cairns, with the neighbouring districts of Ingham and Mourilyan, is even more important than Mackay; Bundaberg and Childers nearly account for another quarter—here the rainfall is about 40 inches per year. Proserpine and Ayr (near Bowen) and Port Douglas (near Cairns) are less important producers. Most of the coastal towns (as also Nanango and Kilkivan, inland) grow some cane, but their total does not bulk largely.

In 1922, 1040 men and 129 small vessels were engaged in the pearl-shell and bêche-de-mer (trepang) industries, with headquarters at Thursday Island. Pearls are found in the shallow waters of Torres Straits, and along the northern coral-reefs of the Great Barrier. The trepang occurs here also; in 1922 it was obtained to the value of £63,630, most of which was smoked and exported as a delicacy to China.

NEW SOUTH WALES.—*Area*: 310,372 sq.m. all in temperate zone. *Rainfall*: all over 10 inches, except 45,000 sq. m. *Population* (1921): 2,100,371 whites, 1597 aborigines. *Chief Towns* (1921): Sydney (926,400), Newcastle (84,372), Cessnock (30,215), Broken Hill (26,337), Parramatta (14,594), Goulburn (12,715), Maitland (12,008), Bathurst (9440), Lismore (8700), Wagga (7679), Orange (7398), Tamworth (7264). *Stock* (1924): horses, 498,194; cattle, 2,625,668; sheep, 37,387,895. *Chief Products*: wool (1922-3) 293,571,000 lb.; wheat (1922-3), 28,660,824 bushels; maize (1922-3), 3,287,500 bushels; potatoes (1922-3), 35,694 tons; sugar (1922-3), 18,580 tons; wine (1922-3), 771,206 gallons; butter (1922-3), 73,705,349 lb.; cheese (1922-3), 5,198,905 lb.; milk (1922-3), 226,863,925 gallons; timber (1922-3), 147,108,000 super feet; gold (1922), 25,222 fine oz.; silver (1922), 749,904 fine oz.; tin (1922), 1144 tons; zinc (1922), 363,681 tons; iron (1922), 54,856 tons; coal (1922), 10,183,133 tons. *Railways* (1921-2): 5475 miles. For statistics of stock, products, etc., not given here see separate articles on HORSES, SHEEP, ETC.

Topography.—In New South Wales, as in most States, we have to deal with peneplains and dissected plateaux, not with ridge-like ranges. The 'Great Dividing Range' is a misleading term, which should be replaced by the term 'Great Divide.'

The topography resembles that of Queensland—the highland area close to the coast, with a steep slope to the east and a gradual slope to the west, the latter merging into central lowlands built up of alluvial. An inlier of very ancient rocks round Broken Hill in the extreme west recalls the Camooweal and Cloncurry inlier in Queensland. The highlands are, however, on a much grander scale than in the northern State; there are large areas over 3000 feet—indeed, New South Wales contains three out of the four considerable plateaux in Australia, the fourth being in Victoria.

The largest area of highland in Australia is the New England plateau in the north-east of New South Wales, an irregular area about 200

miles long by 90 miles wide, all over 3000 feet, and comprising about 9000 sq.m. It is largely a granite plateau of fairly uniform level, but rises to higher levels both north and south. It is absurd to mark this large area as a narrow range, but most maps (even the official Commonwealth map) contain the absurdity. Three bosses between Armidale and Tenterfield (Ben Lomond, Capoompeta, and Chandler's Peak) rise above 5000 feet, and an important spur (Snowy Mountain) extends nearly to the east coast at Bellingen. The southern area, between the anning and Peel rivers, rises to 4000 feet. Outlying portions of the plateau are Sea View and Mount Royal, both over 3000 feet. The scarp on the east is very abrupt, espcially where it is cut by the gorges of the Macleay, and possibly represents a great fault-plane. The northern rim of the plateau is also higher than the general level, forms the Macpherson Range along the border, and rises to 4060 feet in Mount Lindesay. To the west of the plateau, separated from it by a series of folded sediments probably lying in fault-blocks, are two groups of ancient volcanic mountains—the Nandewars near Narrabri, which rise to 4000 feet, and somewhat to the south-west the Warrumbungle Range, of lower elevation, with Mount Exmouth (3000 feet); the latter is connected with the New England plateau by a lower basalt range, the Liverpool Range. Immediately south of the Liverpool Range, near Cassilis, occurs a striking break in the divide, the heads of the west-flowing Talbragar River and of the Goulburn, which flows in a deeper basin eastwards, almost meeting at a height of about 1500 feet. The greater softness of the coal-basin strata has in part enabled the Goulburn to cut back and capture various portions of the western drainage. This Cassilis 'geocol' or Gate is the chief gap in the divide between Roma in Queensland and Kilmore in Victoria—a distance of 1100 miles. Yet it is not yet traversed by railways, which have been built up the steep Blue Mountains south of it and up the New England plateau to the north in defiance of physiographic control.

The main central plateau is an elevated peneplain of heterogeneous composition, which rises to 4460 feet in Mount Bindo, near the Jenolan caves. It has a total area over 3000 feet of about 4000 square miles. Its northern portion (mainly 2000 to 3000 feet high) is a barren tract of sandstone intersected by deep gorges such as the Grose, Kanimbla and Capertee valleys. Apart from the tourist resorts along the western line, and a few fruit-farms on the basalt areas, this region is still one of the least occupied in the State. Westwards the plateau extends to the volcanic knobs of the Canoblas, and the slope is (as usual) quite gradual; on the east is the well-known Blue Mountains monocline, one of the finest later folds in the earth's crust. The effect of this fold—which has buckled the crust through several thousand feet—is described under PHYSIOGRAPHY.

The Lake George Gate is a gap in the Divide leading from the Wollondilly basin on the east to the Murrumbidgee basin on the west. The actual divide bifurcates round Lake George, where a portion of the crust has sunk down and formed an isolated basin. To the south is the Monaro tableland, which consists of a very elevated western portion, containing Kosciusko (7328 feet), the highest mountain in Australia; an eastern portion rising to 5300 feet in Tindery; and a lower longitudinal valley, occupied by the Murrumbidgee and Snowy rivers, between the two. The structure of Monaro depends on several fault-blocks which are discussed under PHYSIOGRAPHY. The two high massifs (about 3000 feet) total about 7000 square miles, and a considerable portion of the intermediate valley is little below the 3000-ft. level. For a few miles round Kosciusko, especially near Blue Lake, there is ample evidence of an ice age that capped the plateau in comparatively recent geological time. Mounts Townsend (7236 feet), Twynam (7200), Bimberi (6264) and Coree (4657) are dominant knobs in the Kosciusko massif; the two latter bound the Federal Territory west of Canberra. Eastwards the plateau is abruptly truncated by the coast, so that there is a rapid fall of 3000 feet on the road from Nimmitabel to Bega.

About three-quarters of New South Wales consists of lowland plains rising from 140 feet (at Wentworth) to the 1000-ft. contour. West of the highland region already briefly described only one small area near Broken Hill (the so-called Barrier Range, about 100 miles long) rises above 1000 feet. But connecting this ancient metalliferous area with the highlands is a broad, low, typical peneplain, called the Cobar peneplain. It has a general level of about 700 feet—little above that of the alluvials to north, west and south—but consists of ancient metalliferous rocks containing large deposits of gold and copper. Elsewhere the western plains are composed of deep recent deposits, carried seaward by the Murray and its tributaries. The land is remarkably level in the south-west. The river-plain is seamed with distributaries and anabranches, which are discussed below.

Hydrography—Coasts.—This State's coastline is the simplest in Australia. It extends for 700 miles almost as a straight line, except for a slight angle near Port Stephens. The coast as a whole is determined by late subsidences; hence the numerous drowned valleys, the steep scarps (so-called 'coastal ranges'), and the short, steep courses of most of the rivers. There are only three small but important coastal plains; the lower Clarence basin round Grafton, the Hunter valley, and the Sydney region east of the Hawkesbury River.

The State's northern boundary is at Point Danger, where a rocky spit renders navigation dangerous. Tweed River lies just to the south. Cape Byron, the most eastern point on the continent, carries a light visible 26 miles. Byron Bay is the outlet for the Lismore and Murwillumbah districts, with which it is connected by rail. The Richmond River, which enters the sea at Ballina, is navigable by small vessels for 70 miles; Lismore, at the head of navigation, is an important centre for sugar, dairy-farms and timber. The next estuary to the south is that of the Clarence River, much more important and 240 miles long. Grafton lies some 40 miles up, and vessels of considerable tonnage can reach it, while launches go 35 miles higher. Proceeding southwards, the New England massif approaches the coast, and near Coff's Harbour an outlier, Bellinger Peak (1350 feet), is prominent. The Macleay River enters the sea south of Nambucca; Kempsey, about 25 miles up, is an important town with a small dock. Smoky Cape, with an important light, is just south of the estuary. Port Macquarie at the mouth of the Hastings River and Taree on the Manning are two small river-towns. Most of these river-towns, as far north as South Grafton on the Clarence, are now connected by rail with Newcastle, and the line will soon be connected by a

bridge with that from Grafton to the Tweed and so with the coastal lines of Queensland.

A salient point on the coast is Sugarloaf or Seal Rocks Point, where there is a light visible for 22 miles; south of it the coast trends more to the west. At Port Stephens it is designed to make a naval port. This inlet, about 11 miles long, receives the Karuah and Myall rivers; bold headlands flank the entrance. Thirty miles south is Port Hunter, the outlet of the Hunter River. Newcastle, the second town of the State, situated on the southern shore of the estuary, is one of the chief ports in Australia, and by far the most important coaling station. Small steamers ply to Morpeth, 40 miles up the winding river. South of Newcastle are several coal-mines, with jetties from which ships are loaded directly, as at Catherine Hill Bay and Lake Macquarie. Drowned estuaries, converted into lagoons by sand-bars, occur at Tuggerah and southwards. Broken Bay is an extensive and picturesque opening where the Hawkesbury enters the sea. Barranjuey Head carries a light visible 15 miles. The river is blocked for large vessels by the railway bridge, but smaller boats can navigate it for 70 miles.

Port Jackson owes much of its pre-eminence to its physiography. It is a drowned steep-walled valley, whose ancient head-waters have probably been cut off by the Nepean River. Hence the waters of the harbour are deep, and require little or no dredging, since mere creeks like the Parramatta 'River' carry down no silt. The Heads are a little over one mile apart. The saltwater portion of the Parramatta River, which is the main branch, and extends 20 miles from the Heads, receives the Lane Cove River and Middle Harbour, each about eight miles long. The city of Sydney is built round and to the south of Circular Quay (seven miles up the harbour) where for many years the mail steamers berthed. Inlets on the southern shore east and west of the Quay have been lined with wharves and berths capable of accommodating vessels up to 40ft. draught.

The suburbs of Sydney stretch for many miles along both shores of the main inlet, north to Middle Harbour and south to George's River. Botany Bay, 12 miles south, is a somewhat larger and much shallower inlet due to the drowning of a plain, and is famous as the first landing-place of the English discoverers. It receives two small streams, Cook's and George's rivers. A few miles south is Port Hacking, another picturesque drowned river. Beyond it coal again outcrops on the coast, and there are several small coal-ports (Bulli, Clifton, Bellambi); but the coast is very open, and important works have been erected to facilitate the loading of coal, etc., at Wollongong and Port Kembla. Kiama is a small town noted for its road-metal quarries and for dairy produce. A little south is the delta of the Shoalhaven River; at its apex is situated Nowra, a town communicating by rail and steamer with Sydney, which marks the southern end of the picturesque Illawarra coast. The Shoalhaven mouth is blocked, and navigation proceeds through a canal to Crookhaven, five miles south.

Jervis Bay, the most striking inlet on the map, is enclosed by two bold headlands that terminate in capes projecting eight miles beyond the general coast-line. The Commonwealth's Naval college has been established on its southern shore, where there will some day be the terminus of a railway from Canberra, and the federal port. For about 160 miles farther south there is a flourishing dairy region, with important mineral deposits. The coast is steep, being the truncated edge of the Monaro plateau. Ulladulla, Moruya, Bega, and Eden are the chief townships, the latter (on Twofold Bay) being also a whaling station. The next promontory is Green Cape, with an important light, and 20 miles to the south a cairn on a low headland marks Cape Howe on the boundary of Victoria.

Rivers.—Except in the far west, the State is fairly well watered. All the inland rivers belong to the Murray system, and there is good reason to believe that many of the coastal streams are disjointed fragments of the same system. There are four main streams, the Murray and its three tributaries the Darling, Murrumbidgee, and Lachlan. The Murray runs for 1200 miles along the Victorian boundary. Of these about 900 (i.e. west of Albury) are navigable, though steamers usually run only to Echuca; Corowa, Swan Hill, Euston, and Wentworth are also important river-towns. The Riverina (the lowland between the lower Lachlan, Murrumbidgee and Murray) is crossed by numerous distributaries, anabranches, and billabongs. The flood-plain is extraordinarily level, and minor channels, such as the Moulamein, Edward, and Wakool, often anastomose. In 1914, for the first time on record, the Murray ceased temporarily to run; this was in part due to the increased demand for irrigation. A dam with a storage capacity of over 1,000,000 acre-feet is being constructed a little above Albury (see IRRIGATION).

The Murrumbidgee is entirely in New South Wales. It is about 1000 miles long, and rises near Kiandra in the Alps (its upper waters having been captured from the Snowy River), flows through the Federal Territory (Canberra is on its tributary the Molonglo) and is dammed at Burrinjuck, where it has cut a deep gorge. This reservoir, one of the largest in the world, covers 12,740 acres. The stored water, when released, runs down the river-bed to Berembed near Narrandera; here a diversion weir sends it into canals that supply the irrigation settlements to the north-west. The river is navigable for small steamers to Narrandera, but here as elsewhere the formerly river-borne trade is being captured by the less intermittent railway service.

The Lachlan is much less important, though about 800 miles long. It rises near Lake George and flows in a generally westward direction. Near Hillston it gives off a distributary (the Willandra Billabong), which in high floods may reach the Murray at Euston. The lower Lachlan in dry seasons is a mere chain of waterholes, and rarely reaches the Murrumbidgee, being lost in reedbeds.

The Darling-Barwon, from Mungindi to Wentworth, is about 1700 miles long. But the longest river in the Murray basin is the Condamine-Balonne-Culgoa-Darling-Murray, which rises at Toowoomba and is a continuous stream 2310 miles long. The Darling proper is navigable in time of freshets as far as Walgett, 1758 miles from its confluence with the Murray. Altogether the Murray River system provides 4200 miles of more or less navigable waterway. The Murray is usually navigable for seven months (July to January), but the Darling is sometimes too shallow for a year or more at a time. A comprehensive scheme of locking is proposed for these rivers, primarily to improve them for irrigation, but also to assist navigation.

The north-eastern tributaries are smaller, but of considerable length. The Macquarie, 590 miles long, rises in the hills west of Jenolan, flows

northward through Bathurst, Wellington, Dubbo, and Warren, and is usually lost in marshes before reaching the Darling. The Namoi, 430 miles long, drains the Liverpool Range and the south-west of New England; Tamworth, Gunnedah, Narrabri, and Walgett are important towns on or near it. The Bogan, Castlereagh, and Gwydir are each about 350 miles long. The Paroo and Warrego, nominal tributaries of the Darling on its north-west bank, are of little importance except in flood-time.

The chief coastal river is the Hunter-Goulburn, about 350 miles long, which rises in the Cassilis Gate already described; the upper Hunter is really a tributary. Singleton, Maitland, Cessnock, and Newcastle are the chief towns in its valley. The Hawkesbury, about 335 miles long, is known by different names in various parts of its course, which were discovered independently and named before it could be ascertained that they were connected. Its farthest source is that of the Mulwarree Ponds Creek near the southern end of Lake George. This creek runs north to join the Wollondilly a little north of Goulburn, and under the latter name traverses deep gorges (of which Burragorang is the best-known) in the ranges west of Berrima and Picton until it receives the Cox River from the Blue Mountains. Thence known as the Warragamba, it flows through another gorge into the Nepean, takes that name, and proceeds NE. past Penrith to meet the Grose; from the junction with this river the stream is known as the Hawkesbury, and passes Richmond and Windsor to enter the drowned estuary at Broken Bay.

The Shoalhaven, over 200 miles long, rises behind Moruya, flowing due north in an ancient valley to Marulan. Here it has been captured by the lower Shoalhaven, a coastal stream which has cut a gorge 1600 feet deep across its course. Braidwood in the upper valley and Nowra near the mouth are the only townships worth mention.

The Clarence is another complex system, many north-south streams (the Timbarra, Nymboida, etc.) having been captured by a coastal stream which enters the sea below Grafton. The main stream, nearly 200 miles long, drains all the north-eastern side of New England. The Richmond, farther north, is 160 miles long. The Macleay, a striking river, is another composite. The Guyra rises under Ben Lomond and picks up the Chandler (an almost parallel stream) and the Apsley running north from the Hastings Range; the united stream, known as the Macleay, traverses a deep gorge, emerges into alluvial flats, and enters the sea at Trial Bay. All the upper tributaries have canyons of their own, and the Wollomombi, Dangar, and Apsley falls are fine sights in flood-time. The Manning, Hastings, and Bellinger have been already mentioned. The south-coast streams (Tuross, Clyde, and Bega), each about 70 miles long, are of little importance. The Snowy River, which rises under Mount Kosciusko, flows 170 miles through the south-east of New South Wales before entering Victoria. Bombala is the chief town in its basin.

Artesian Water.—The Great Artesian Basin underlies 80,000 square miles in the north-west of New South Wales. The southern boundary runs through White Cliffs, Bourke, Dubbo, Narrabri, and Boggabilla. There are 486 bores in the State, arranged chiefly in two belts. The eastern belt lies east of the Barwon, bores being especially abundant near Coorallie and Moree; the other lies between the Paroo and the Culgoa. Boronga bore, near Boggabilla, is one of the most important; it is 4338 feet deep, and supplies over one million gallons daily. The bores are chiefly of value for watering stock. Seventy of them, mostly in the eastern belt, supply some four million acres, divided into bore-water trusts; this renders small grazing holdings possible.

Population.—At first glance the population map presents a very chequered appearance. This is due to the mingling of several controls, which can, however, readily be differentiated. As usual, rainfall and topography exercise the chief influence; but mineral deposits and centralization are also potent factors.

The dominant population-line (isopleth) runs from Hay to Moree; all to the west is sparsely populated, all to the east moderately populated. This line almost coincides with the 10-inch winter isohyet, which practically controls the wheat-crop and determines the western boundary of agriculture and close settlement. All to the west is pastoral, except the silver-lead region round Broken Hill and the copper region round Cobar. The relative distribution of population in the west depends chiefly on communications and water frontage. The three least settled areas in the State are round Ivanhoe (between the Darling and the Lachlan, and but recently linked to the railways) and round Wanaaring and Milparinka, remote alike from the Darling and from railways. The mining-fields of Tibooburra and White Cliffs probably account for the larger settlement between the two latter areas. The next main isopleth agrees fairly closely with the 30-inch isohyet, both in the north and as regards the chief gates that break up the highlands. The three major centres of settlement away from the coast are the Wagga-Albury, Young-Orange and Armidale areas, each of them on the western slopes of one of the three massifs described earlier. Though the eastern sides are nearer the coast and the capital, they are in general too rugged for close settlement, as is well shown in the north, where the slopes near Drake (Clarence valley) and Nowendoc (Manning valley) are almost uninhabited. The rugged area of the Federal Territory is also sparsely inhabited, and in the eastern part of the main central plateau settlements are comparatively rare except along the western railway line. The tongue of low population reaching down the Cassilis Gate almost to Sydney coincides largely with the barren sandstone, which is practically useless for grazing or agriculture.

The coastal regions of close settlement are scattered somewhat irregularly. The metropolitan area (including Sydney and suburbs) accounts for 43 per cent of the whole State. If the four adjoining counties are added, the percentage rises to 57. This congregation of people is in part due to the peculiar arrangement of the coal outcrops. Mines at Newcastle, Maitland, Lithgow, and Wollongong are all on the exposed rim of a buried basin of coal, which is also found 3000 feet below Sydney itself. Tongues of close settlement extend along all the railway lines, and important tourist centres have grown up on the sterile sandstones round Katoomba and Mount Victoria; elsewhere dairying, orchards and agriculture are the chief occupations of the people.

An interesting, somewhat isolated population inhabits the extreme north coast round Lismore. Here fertile soils and heavy rainfall have off-

set the distance from markets, so that dairying, timber-getting, cane-growing, orchards, etc., flourish, and support the eighth town in the State. Similar but less important settlements cluster round Grafton and Bellingen. The south coast has lagged behind the north, though it has been settled far longer. A district which is bound to grow rapidly is the irrigation settlement west of Narrandera, where a new railway is built to Griffith. The Federal capital area (south-west of Goulburn) is very sparsely populated, being essentially a sheep-grazing region. Canberra is seven miles west of Queanbeyan on the Goulburn-Cooma line, and is to have railway connection with Yass on the north, and with Jervis Bay via Queanbeyan on the east. The Commonwealth's Military College is at Duntroon, just outside Canberra. The whole Territory is 940 square miles in area (see CANBERRA).

Products.—The wool trade is by far the most important in the State. Forty-three per cent of Australian *sheep* belong to New South Wales, though the numbers have decreased from 56 millions in 1890 to 35 millions in 1922-3. The value has not varied much, being usually about £14,000,000 for wool and mutton. Sheep are spread through the State (except on the north coast, where other industries are more profitable), and are most densely distributed over the tablelands and western slopes. Here, however, they have rivals in farming and mining, but in the drier western plains they reign supreme. The merino breeds constitute 80 per cent of the whole. The coarse-woolled breeds are chiefly Lincoln and Lincoln crossed with merino. As in other States, rabbits are a menace to the pastoral industry. Rabbit-proof fences totalling 100,000 miles have been put up, notably along the western and north-western borders and from Bourke to Corowa. Their cost has amounted to £6,000,000.

Of *cattle* New South Wales has only half the number reared in Queensland. They are most numerous in the wetter regions, especially in the north-east, where the county of Rous (round Lismore) contains about 10 per cent of the whole number. About 60 per cent are contained in the coastal counties, including most of the dairy cows. Inland, the northern tableland is important, but the other regions are much less dense, while the whole western division (i.e. the area west of a line from Mungindi to Moulamein) contains only half as many as the single county of Rous. Dairies are almost confined to the coast. The principal breeds, according to Trivett, are Shorthorns, Herefords, Jerseys and Ayrshires; the chief crossbreds are between Shorthorns and one or other of the other three.

The region of greatest *wheat* production is in the Riverina, and extends thence north-east to Molong along the western slopes. The control is purely that of rainfall, and the next grade (100 bushels to the square mile) extends almost across the State. The low rainfall in the Cassilis Gate is probably responsible for the break in the belt hereabouts. The outer limit is ever moving westward, but agrees very closely with the 10-inch winter rainfall (April to October). A little more rain is needed in the north than in the south, to counteract the greater evaporation. Very little wheat is grown in the moist coastlands.

The *forest* areas cover about eight per cent of the State, confined mainly to the wetter coastal districts. Forests are of two types. Over most of the area east of the 20-inch isohyet they consist of eucalypts, but along the north coast are large softwood 'brushes,' akin to the tropical forests of Queensland, and (according to Baker) controlled largely by the presence of fertile basalt soils. The county of Rous, the Dorrigo plateau (behind Bellingen) and the upper Hastings valley contain most of the 'brushes.' Cedar, hoop pine, beech (*Gmelina*), black bean, rosewood (*Dysoxylon*), and sassafras are the chief cabinet and softwood timbers of the State. The eucalypts have somewhat specialized habitats also. Ironbarks are commoner in the coastal regions and warmer tablelands, and tallow-wood (*Eucalyptus microcorys*) along the north coast. Murray gum (*E. rostrata*) is ubiquitous in Australia, but forms forests along the Murray. Blackbutt (*E. pilularis*) occurs along the coast also. Less valuable boxes and stringy-barks grow throughout the highlands, while an allied genus (turpentine) is found along the coast. On the drier western slopes is the valuable cypress pine (*Callitris*).

The *sugar* industry is confined to the north-eastern corner of the State. Acreage and production have decreased somewhat since 1896, as dairies have developed so greatly in the counties of Rous, Richmond, and Clarence. There are only about 400 employees, and the small mills are now closed, three larger ones handling the whole output; these are situated at Maclean on the Clarence River, Wardell on the Richmond, and Condong on the Tweed. The *maize*-crop is second only to the wheat-crop. It requires more moisture and more heat; half the crop, therefore, is grown round Grafton, Kempsey, and Lismore on the north coast. Inverell and Tumut on the western slopes, and Windsor in the Sydney district, are also large producers. The *wine* industry is scattered all through the east and south of the State. Maitland and Albury are the chief centres, while Liverpool, Mudgee, Penrith, Singleton, Wagga, and Wentworth have each about one-sixth of the production of the two first localities.

Mining is a very important branch of industry in the State. In 1922 an average of 30,904 men were employed; 21,492 worked on the coal-mines in the Newcastle-Bulli basin, 4712 on silver, lead, and zinc at Broken Hill, and 4700 were scattered through the rest of the country. The paramount importance of Broken Hill is obvious. For the period 1916-19 metals to an annual average value of over five millions were obtained from Broken Hill; during the next two years the industry was completely dislocated by strikes, but is recovering. Their geology and mineralogy is discussed elsewhere, but notes on their situation deserve consideration here. Broken Hill is an outcrop of Cambrian or older rocks structurally akin to South Australian deposits; it is, in fact, only 30 miles across the boundary, and has always looked to Adelaide as its base. About 250 miles away south-westwards is Port Pirie, where much of the smelting is done, and the fluxes come largely from Iron Knob. On the other hand, it is 600 miles from the coast near Sydney, and has never had much direct connection by the coach-routes through Wilcannia, etc. A railway is now being built from Condobolin through Mount Hope, Ivanhoe, and Menindie to Broken Hill—a stretch of some 350 miles; the line will open up some of the least settled parts of the State, and greatly increase the pastoral wealth of the region traversed. At Yerranderie, about 80 miles SW. of Sydney, on a tributary of the

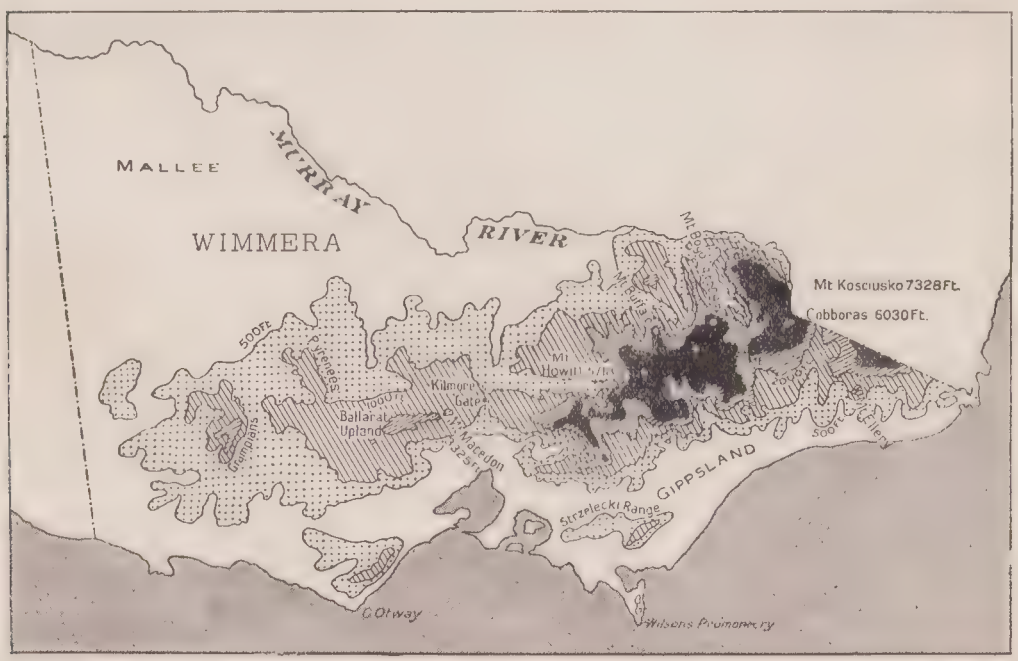
Wollondilly, there are smaller but valuable silver-mines.

The State's *coal* supply is the best in the southern hemisphere. Pittman has estimated that the Sydney basin contains 115,347 million tons of coal. This basin includes three series of payable coal-seams. The upper (Newcastle) series is the chief, and outcrops at Newcastle (N.), Lithgow (W.), and Bulli (S.). It has also been worked from a shaft 3000 feet deep in Sydney, which is in the centre of the basin. The middle series is worked chiefly near Maitland; the lower (Greta) series, which contains the thickest and best coal, is worked chiefly near Cessnock, but isolated areas of the same age are found at Wingen (70 miles NW.) and at Ashford on the Queensland border. The coal that outcrops in the Clyde River gorge (20 miles W. of Jervis Bay) is of the same age. The Newcastle district raised seven million, the Bulli district two million, and the Lithgow district one million tons of coal in 1922. On the western rim of the basin kerosene shale (torbanite) has been developed in the gorges at Newnes, Hartley, and Joadja. Coal is exported chiefly from Newcastle and goes to Chile, New Zealand, Java, India, United States, and the Philippines. Foreign export took nearly three million tons in 1921; the other Australian States (chiefly Victoria and South Australia) took about 2¾ million; and five million tons were used in the State.

Gold is of comparatively small importance. Nearly half the total supply comes from the Cobar district, especially from Canbelego. At Araluen in the Moruya basin, and at Adelong and Gundagai near the middle Murrumbidgee, there are important dredging plants. *Copper* is also a minor product, the value in 1922 being barely a twentieth of what it was in 1918. The Cobar district, for many years the largest producer in the State, has of late years supplied none. Tasmania and New South Wales are equal producers of *tin*, and are considerably ahead of the other States. It is found chiefly in the granite slopes on the north-west of the New England plateau. Emmaville, Tingha, Wilson's Downfall, and Glen Innes were the chief producers in 1920. A later find of considerable value is Ardlethan, on the edge of the Murrumbidgee irrigation areas in the south. Dredges are used largely in the north.

Iron deposits of any value are rare. The chief is near Cadia, south of Orange; a second is at Carcoar in the same district. At Turrawan near Narrabri on the north-western slope a valuable deposit of iron oxide has been developed lately. A large amount of iron is manufactured by the Broken Hill Company at Newcastle; the ore comes from Iron Knob in South Australia, and is brought to the coal-fields for smelting. Among other valuable minerals are *opals* from White Cliffs (north of Wilcannia) and Lightning Ridge (north of Walgett); *alunite* from Bullahdelah near Port Stephens; and *diamonds* from Tingha in New England.

Victoria.—*Area*: 87,884 sq. m. all in temperate zone. *Rainfall*: all over 10 inches; maximum at Weeaproinah (78.9 inches). *Population* (1921): 1,531,280 whites, 111 aborigines. *Chief Towns* (1921): Melbourne (795,100), Ballarat (36,411), Geelong (31,686), Bendigo (30,401), Warrnambool (7730), Castlemaine (5331), Mildura (5101), Hamilton (5097), Maryborough (4744), Ararat (4653), Stawell (4413). *Stock* (1922-3): horses, 494,947; cattle, 1,785,660; sheep, 11,765,520. *Chief Products*: wool (1922-3), 102,467,950 lb.; wheat (1922-3), 35,697,220 bushels; potatoes (1922-3), 148,354 tons; wine (1922-3), 1,717,490 gallons; apples (1922-3), 2,089,017 bushels; butter (1922-3), 84,355,940 lb.; cheese (1922-3), 3,754,960 lb.; milk (1922-3), 249,321,522 gallons; timber (1922-3), 118,336,000 super feet; gold (1922), 106,872 fine oz.; coal (1922), 559,284 tons. *Railways* (1921-2): 4375 miles. For statistics of stock, products, etc., not given here see separate articles on Horses, Sheep, etc.



Topography.—In Victoria the highlands run east and west, separating the northern and north-western plains from the coastal plains in the south. Nevertheless the grain (running north and south), so noticeable in the rest of eastern Australia, is still obvious in three striking features of the Victorian highlands—the Omeo Gate, the Kilmore Gate, and what we may call the 'Howitt' scarp. These are all probably due to north-south faults, as the stratigraphy shows.

The Benambra highlands are the continuation into Victoria of the Kosciusko highlands. The name 'Bowen Mountains' is given to the highest portion, containing the Cobboras (6030 feet); a long plateau extends north to Mount Gibbo (5764). This region comprises about 600 square miles over 3000 feet. A more isolated area (which is, however, linked to the Nimmitabel plateau in New South Wales) of about 300 square miles of highland has Mount Ellery (4255 feet) as its highest point. The Omeo Gate links the head-waters of the Tambo to the Mitta Mitta, which has captured all the previously south-flowing streams near Omeo. It is a remarkable gap about 2800 feet high, between two plateaux of 4700 feet. The chief plateau of Victoria contains Mount Bogong (6509), Mount Feathertop (6306) and five other summits over 6000 feet; it covers an area of about 2700 square miles above the 3000-ft. contour, and extends westward to the heads of the Goulburn and Delatite. Here are Mounts Howitt (5718) and Tamboritha (5381). A spur runs north to Mount Buffalo (5645), which overlooks Bright on the Ovens. The Dargo and Bogong 'high plains' are sheets of older basalt, covering streams of an ancient river-system now 3000 feet above the present watercourses. West of Mount Howitt the plateau character gives place to a much dissected block of highlands, whose main ridge is called the Hume Range. A high spur projecting southwards ends in Mount Baw Baw (5062), but only a few peaks rise even to 4000 feet. The highlands rapidly decrease in height to the west; Mount Disappointment at the side of the Kilmore Gate is only 2631 feet, and Mount Dandenong, at the western end of the southern rim of the Yarra valley, is 2077 feet high.

The Kilmore Gate is just over 1100 feet high. Northward extend lowlands as far as the Gulf of Carpentaria; just to southward lies Melbourne, and to the west stretches an extensive region of uplands, almost all between one and two thousand feet. Mount Macedon is a local elevation reaching 3325 feet, but nothing else as high is met with except in the Grampians far to the west. Low spurs extend north from this 'Ballarat upland' (as we may call it from its chief town); one spur culminates in Mount Alexander (2430 feet), the other forms the Pyrenees. The Mount William Gap separates these uplands from the Grampians to the west. These are faulted blocks of ancient sandstone, which run north and south; Mount William, the highest point, reaches 3829 feet. There are several isolated uplands near the coast—the Otway Range, rising to 1912 feet in Mount Sabine, and the Strzelecki and Buln Buln ranges in western Gippsland, with Mount Fatigue (2110 feet). A granite outlier that builds up Wilson's Promontory rises to 2350 feet.

The plains of Victoria flank the main highlands to north and south. They have their greatest extent in the north-west, which includes the Mallee and the Wimmera; the former is characterized by a close-set scrub of dwarf eucalpyt (mallee) which is gradually giving place to wheat; the Wimmera is better watered, and traversed by several important rivers. The same holds true for the plains farther east, which are described later in connection with the rivers and irrigation.

The southern valley may be considered in three divisions. In the west are bare basalt plains extending from the Glenelg to Geelong; the central division consists of the drowned portion forming Port Phillip and Western Port, and the adjacent plains south of Mount Dandenong—these are better watered, and carry good timber; the eastern division comprises Gippsland and, gradually narrowing, extends eastwards to Cape Howe.

Hydrography—Coasts.—The Glenelg discharges near the western boundary, and thence eastwards the coast is low to near Cape Bridgewater (441 feet). Cape Nelson, close by, has an important light. In Portland Bay is the oldest permanent settlement in the State, now an important port connected by rail and steamer with the capital; off this bay is Lady Julia Percy Isle, a noted resort for seals. Port Fairy is a small port farther east. Warrnambool, near the mouth of the Hopkins, is the chief town along this coast. The main products of all this district are wool, potatoes, pigs and dairy produce.

As the Otway ranges are approached the coast becomes more rugged, but there are settlements at Port Campbell, Apollo Bay, and Lorne. Cape Otway is crowned by a powerful light 300 feet high, visible 24 miles.

Port Phillip entrance, between Point Lonsdale and Point Nepean, is about 1½ miles wide. The strong tidal stream over the shallow entrance is called the 'Rip.' The bay is 31 miles long and about 20 wide; Corio Bay, near its mouth, runs 15 miles farther west. The coast is for the most part low, except in the north-eastern and south-eastern corners. Queenscliff, with a fort and pilot station, lies just inside the western head; a railway runs thence to Geelong and Melbourne. Bellarine Peninsula, rising to 463 feet, bounds the south of the Corio Bay arm. On it is Portarlington, a small settlement facing towards Melbourne. Geelong, an important town on Corio Bay, collects the produce of the western plains, and is connected with Melbourne and Ballarat by rail; there is also some inter-State trade. A long stretch of low coast-line, carrying little or no settlement, extends along the western shore of Port Phillip. At Point Cook, about 10 miles from Williamstown, is the military flying school. The last-mentioned town (really a suburb of Melbourne) occupies a tongue of lava that hems in Hobson's Bay; it is a minor naval base, and has many factories. Port Melbourne, across the Yarra, is the regular place of call for large oversea steamers, but inter-State steamers and other vessels usually proceed via the Coode canal and lower Yarra to Melbourne itself.

Commercial Melbourne, about two miles north of the bay, has grown up chiefly on the northern slopes of the Yarra round the first settlement made by Batman and Fawkner. The chief residential portions lie to the east and south-east, extending almost uniformly within a radius of eight miles or so. The eastern shore of the bay is much more picturesque than the west, and residences are now almost continuous to Frankston, 27 miles down; Mornington,

Dromana and Sorrento, nearer the Heads, are residential townships for holiday-makers.

Between Port Phillip and Western Port lies Mornington Peninsula; its southern point is Cape Schanck, a bold headland with a light visible 23 miles. Western Port is almost filled by two large islands, Phillip Island and French Island. A naval station (Flinders) is situated near Stony Point on the western shore. Cape Wollamai, at the south-eastern end of Phillip Island, is a picturesque granite headland. San Remo and Powlett River are small tourist and dairy towns, while Wonthaggi and its hinterland have valuable coal-fields. The rocky peninsula of Wilson's Promontory is a national reserve; to the east is Corner Inlet, with Toora and Westport on its northern shore; Port Albert and Alberton are fishing-grounds farther east.

The Ninety-mile Beach is a continuous sandy beach, much broken by inlets and small streams. A line of lagoons lies behind the dunes, and thence low tea-tree country extends for miles. The long line of Gippsland lakes opens through the beach by an artificial cut made in 1889, the old entrance being closed by drifting sands. Steamers ply inland 45 miles from Lakes Entrance to Sale on the Thomson River, and for 20 miles up to Bairnsdale. Eastwards lies a similar sandy beach, extending as far as the Snowy River, where there is a small settlement at Marlo. Cape Everard is a granite headland carrying a powerful light. Point Hicks, near Ram Head, is possibly the first point sighted by Cook in 1770. Somewhat east is Mallacoota Inlet, the shallow estuary of Genoa River. Gabo Island, off this inlet, is formed of red granite, which is quarried for export; a powerful light, visible 20 miles, crowns the island. Six miles east is Cape Howe on the State boundary.

Rivers.—The main river is, of course, the Murray, which forms the State's northern boundary for about 1200 miles. It has been described in connection with New South Wales. Below Albury it flows through a broad flood-plain, at first 500 feet above the sea, but at the South Australian boundary only 57 feet above. The tributaries that enter it east of Swan Hill have at first steep courses, and flow through well-watered country; those farther west flow almost wholly through low plains and, as the rainfall is small, usually fail to reach the main river. The Mitta Mitta rises near Mount Hotham, flows south, and then bends sharply to the north, passing through deep gorges near Mount Bogong; it is 125 miles long, and Tallangatta is the chief settlement on it. The Ovens River (110 miles) rises on the north side of Mount Hotham and flows through Bright and Wangaratta. The Goulburn River—the chief tributary, 280 miles long—rises near Wood's Point, and at first flows due west through Alexandra to Seymour; here it turns to the north, and flows normally to join the Murray, passing through Nagambie, Murchison and Shepparton. The Campaspe (100 miles) waters Rochester, and reaches the Murray at Echuca. The Loddon (155 miles) rises near Daylesford; Maryborough, Inglewood, and Kerang are on or near its banks. The Avoca rises on the Divide, flows north through Avoca and Charlton, and splits into two main streams, neither of which reaches the Murray; they empty into the shallow basins known as Lakes Tyrrell and Bael Bael. The Wimmera (155 miles) drains the northern Grampians, and has captured several parallel streams near the uplands, but dwindles away on the plains, and ends blindly in lakes (Hindmarsh, Albacutya, etc.), 100 miles from the Murray. Stawell, Glenorchy, Horsham, and Dimboola are some of the chief towns in its basin.

Of the coastal rivers the Glenelg (280 miles) is the longest; it rises in the Grampians, and flows west nearly to the boundary of South Australia, then turns to the south and, passing through Casterton, reaches the sea at Nelson. The Hopkins (135 miles) and its longer tributary Mount Emu Creek (170 miles) drain the basalt plains from Ballarat and Ararat to the sea. The Barwon runs through broken country south-east of Ballarat; it used to enter Port Phillip at Geelong, but now passes through Lake Connewarre to the open sea. The Yarra, a fine stream 115 miles long, rises near Mount Baw Baw and flows west, parallel to the upper Goulburn; it originally drained south towards Sorrento, but was drowned when Port Phillip was formed. Nowadays its stream is salt from near Kew downwards through Melbourne itself into Hobson's Bay. The Latrobe flows east along the broad valley between the southern Gippsland ranges and the main highlands; it receives the Macalister from the north, and passes through Lakes Wellington, Victoria, and King to reach the sea. The Tambo (90 miles) and Mitchell also enter by Lake King. The Victorian portion of the Snowy River is 95 miles long; it flows through rough country south of the border until the coastal plain is reached. Orbost is the only town on the Victorian portion.

Lakes.—Several lakes (e.g. those due to silting and deviation in the Mallee and Wimmera, and the sand-bar lakes of Gippsland) have been already mentioned. In the western basalt plains irregular hollows in the lava sheet, between the valleys of the Barwon and Mount Emu Creek, receive local drainage; Lake Corangamite has an area of 72 square miles. Others, such as Bullen Merri and Koroit (Tower Hill), are due to subsidence in volcanic areas; while some (e.g. White Lake near the Glenelg) are, according to Gregory, due to the removal of soluble limestone.

Irrigation, etc.—Artesian supplies are not of great importance, but small bores (about 200 feet deep) are in operation round Sale in Gippsland. In the Mallee the extension of the Pinnaroo (South Australia) basin has been tapped by about 80 useful bores; the water is obtained by pumping, only three having a true artesian flow. Many other bores are scattered through the north-west, but a great number are brackish or salt. The need of level agricultural land and an adequate water-supply have confined the chief irrigation areas to the central northern and north-western slopes of the highlands. The works are roughly of two kinds—complete irrigation, and stock-watering; for an account of these see IRRIGATION.

Population.—Topography, rainfall, and accessibility have determined how settlement has progressed in Victoria, perhaps more clearly than in most other parts of Australia. In an especial degree the population congested round the capital, no less than 50 per cent of the whole living in 'Greater Melbourne' in 1921. The area containing more than 16 persons to the square mile comprises Bourke, Grant, and Mornington counties round Port Phillip, and extends west and north-west to include Bendigo, Castlemaine, and Ballarat. The population has been drawn in this direction by rich mineral deposits, and by open agricultural lands with good rainfall (20-30 inches). The nearer

counties to the north-east are rugged and heavily timbered, and are only sparsely inhabited even along the rivers. The next zone (over eight persons) includes the wet coastlands, where dairying reigns supreme, as well as the irrigation areas and rich wheat-lands of the north. Warrnambool, Morwell, Shepparton, and Wangaratta are centres in this zone. More sparsely-settled districts lie west and north-west, and include the Wimmera and eastern Mallee. To the east are similar (but rugged) districts, with many small farms and small mines in Delatite and Benambra. Central Gippsland, round Bairnsdale, belongs to this zone. The dry scrubby north-west of the Mallee, the plateaux round Mount Howitt, Mount Hotham and the Cobboras, and the counties to the east beyond the Tambo are still almost uninhabited.

Products.—The number of *sheep* has not altered appreciably since 1880, newer districts taking the place of those where farms have replaced sheep. The 'Western District' is their chief habitat, especially the Hopkins valley, but the whole area between Seymour and the Glenelg is well-stocked.

Among less important zones are the Wimmera, the northern districts, and Gippsland. In the outer counties to north-west and east there are very few sheep. The chief sheep-area lies between the 20- and 30-inch isohyets. Districts with over 30 inches carry distinctly fewer sheep. If the country is accessible and fairly level, it is better suited for dairies and farms; if it is rugged, it is usually devoted to cattle.

Cattle are most numerous in regions of heavy rainfall, southern Gippsland and Mornington being the chief areas for both types of cattle; the Western District comes next in order for dairy cattle, and the north-east is important for other cattle. The whole of the State, however, except the north-west—where the large county of Weeah has only about 2000, and Millewa 400 head—is cattle country. Among the chief dairy centres are Colac, Terang, and Warrnambool in the south-west; Alberton, Maffra, Morwell, and Bairnsdale in Gippsland; Poowong and Berwick, nearer Melbourne; and Shepparton, Wangaratta, and Kerang north of the Divide.

The production of *wheat* has steadily increased from 10 million bushels in 1880 to 36 million in 1922-3. In the northern and north-western districts wheat is most abundant; three counties, Moira (Shepparton, Numurkah, and Tungamah), Borung (Horsham, Murtoa, Dimboola, and Warracknabeal), and Karkarook (Walpeup, Ouyen, and Birchip) grow over 40 per cent of the whole. Other important northern districts are Swan Hill, Kerang, Boort, and Korong (all in or near the Loddon valley), and Wycheproof near Birchip. The chief wheat-growing areas are enclosed between the 10-inch and 15-inch winter isohyets. Apart from the localities noted above, outlying districts south of Ballarat and north of Sale are of special interest. Both are 'rain shadow' regions in the lee of mountains, where the rainfall is considerably below that of neighbouring counties; wheat therefore to some extent replaces dairying, which needs more moisture.

Oats are an important crop in the north-central region, extending approximately from Ararat to Albury. They are also grown to some extent throughout the wheat areas. About 88,000 acres are devoted to *fruit* (apples, etc.), of which half are in the three counties of Bourke, Mornington, and Evelyn; the chief centres are Doncaster, Lilydale, Eltham, Frankston, and Berwick. Proximity to Melbourne and a rainfall of 30 inches are the chief controls. *Potatoes* are an important crop along the south coast. Dandenong, Berwick, Warrnambool, and Belfast, with the Ballarat and Daylesford districts, are the chief producing areas; their rainfall is usually from 25 to 30 inches.

There are about 12 million acres of *forest* in the State, distributed chiefly in the south, east, and centre, where the rainfall is adequate. The western basalt plains are almost treeless, though forests grow where protected from stock and fires. In eastern Victoria the stringy-bark (*Eucalyptus amygdalina*) and messmate (*E. obliqua*) cover almost all the highlands. Other important timbers of the slopes are ironbark, grey box, blue gum, spotted gum and blackbutt; red gum occurs along the Murray. The most valuable cabinet timbers are the blackwood (*Acacia*) and evergreen beech, both of which occur only in the wettest coast-lands. About half the output of sawn timbers comes from the upper Yarra and the Otway forests.

One out of every three Australian *vineyards* is in Victoria, which ranks next to South Australia as a wine-producer. Seventy per cent of the wine comes from the Mildura and Rutherglen districts, both on the Murray. Other important centres are Swan Hill, Shepparton, Benalla, and Chiltern, but there are smaller areas round Lilydale, Maryborough, Ararat, and Stawell.

Victoria has few important metals except *gold*, and the output of this has gradually diminished in value from 3½ millions in 1899 to about half-a-million in 1922. The auriferous country occurs patchily among the older rocks of the highlands. The chief producers are Bendigo, Beechworth, Castlemaine, and Ararat. Maryborough and Ballarat are of much less importance. *Antimony* in marketable quantities is found near Heatheote. *Tin* occurs in the coarse granites of the north-east near Beechworth, and along the Mitta Mitta valley to Cassilis. There is also tin-sluicing on the south coast, near Toora on Corner Inlet. *Coal* occurs in two forms, as bituminous coal of Jurassic age, and as brown coal of lower Tertiary age. The former is worked chiefly at Wonthaggi and Korumburra, east of Western Port; it is reported that 30 million tons are still available. Brown coal is distributed along a belt from Ballarat to Gippsland, showing at Lal Lal, Altona, Morwell, and Alberton. The Morwell bed is one of the thickest in the world—780 feet of hydrous brown coal; it will undoubtedly be of great importance as a power-producer in the near future. The scheme for using it to supply Melbourne with electricity is discussed under MORWELL.

TASMANIA.—*Area*: 26,215 sq. m. all in temperate zone. *Rainfall*: all over 10 inches; maximum at Mount Lyell (116.7 inches). *Population* (1921): 213,780 whites. *Chief Towns* (1921): Hobart (53,803), Launceston (24,305). *Stock* (1922-3): cattle, 218,197; sheep, 1,558,494. *Chief Products*: wheat (1922-3), 569,587 bushels; potatoes (1922-3), 101,201 tons; apples (1922-3), 3,127,509 bushels; timber (1922), 45,564,000 super feet; gold (1922), 3431 fine oz.; silver (1922), 794,585 fine oz.; copper (1922), 5616 tons; tin (1922), 679 tons. *Railways* (1921-2): 873 miles. For statistics of stock, products, etc., not given here see separate articles on HORSES, SHEEP, etc.

Topography.—Tasmania is a triangular expanse of land, mostly over 1000 feet in elevation. The lowlands are confined to the broad valleys of the Tamar and the Derwent, which both run NW. and SE., parallel to the grain of the country. A third parallel valley is formed by the Gordon-Huon valleys, which join near Lake Pedder in the south-west of the State. The chief block of highlands occupies the north-central portion of the island, and rises to 5069 feet in Cradle Mountain towards the west. More important is the broad stretch of the central plateau, everywhere over 3000 feet, which contains numerous large lakes. This plateau is truncated somewhat abruptly on the north and east, forming the Western Mountains (Dry's Bluff, 4257 feet); to the south the descent is more gradual, the Derwent having eaten away a large portion of the plateau. West and south of it there lies a series of high ridges or narrow plateaux—Eldon, Hugel, Field West, and Wellington—all over 4000 feet high. In the south-west is another parallel series of mountains—the Wilmot, Arthur, and Hartz ranges—from 3000 to 4300 feet in height. The highest point of the island (Legge's Peak, 5160 feet) is on the isolated Ben Lomond massif in the north-eastern corner, almost completely cut off from the rest of the State by the valley of the South Esk. Many isolated portions of the central plateau fringe its rim; thus to the north-west are outliers including Mount Lyell (2750), Mount Zeehan (2500), and Mount Bischoff (2598), round which are some of the richest ore-deposits in the world. In the extreme east is Mount Nicholas (2812), dominating the chief coal area, while farther south in the same uplands is Mount Brown (2598).

Hydrography—Coasts.—The north-eastern corner is Eddystone Point, with a powerful light visible 18 miles. To the north-west lies Ringarooma Bay, into which enters a river of the same name; Boobyalla is a small town at the mouth. Bridport lies at the head of the next (Anderson) bay. Stony Head, a conspicuous headland nearly 300 feet high, is a little east of the mouth of the Tamar. The estuary, called Port Dalrymple, has a lighthouse at Low Head; Launceston, 38 miles up the river, can be reached by boats drawing 21 feet, and Georgetown and Beaconsfield are important towns on and near the estuary. Port Sorell and Devonport are drowned river-mouths to the west. On the latter (the estuary of the Mersey) is an important town of the same name, connected by steamer with Melbourne and Launceston; vessels of 22-ft. draught visit it, and large supplies of potatoes and oats are exported. Ulverstone, at the mouth of the Leven, is the next large town, but Burnie is the chief port for this district; it lies on Emu Bay, and is the terminus of the north coast railway and of the mining railway to Zeehan. Wynyard near Table Cape has a light visible 27 miles, and 25 miles west is Stanley on Circular Head, a mass of basalt nearly 500 feet high. Oats, potatoes, fruit, and stock are exported. Robbins Island and Barren Island lie off the north-western corner of the State, and protect the north coast from westerly gales. Walker Island has been separated from Robbins Island since 1800.

The whole of the west coast is practically uninhabited, except for one or two small villages and the port of Strahan on Macquarie Harbour. The coast is rocky and sterile, and usually has a heavy swell rolling in from the south-west. Arthur River enters the sea about 25 miles south of Cape Grim, and Pieman River 45 miles farther on. Mounts Heemskirk and Zeehan were probably the first portion of the island sighted in 1642 by Tasman; the range of which they are part rises to 4739 feet in Eldon Mount. Macquarie Harbour, 19 miles long, is a drowned estuary of the Gordon. A light on Cape Sorell at the western head is visible 20 miles. The King River enters the harbour, and Strahan is near its mouth; behind it lies a rich mining district, from which a railway runs to Mount Lyell, Zeehan, and Burnie. Farther up the harbour is Pillinger, connected with Mount Lyell by tram. South of Cape Sorell the coast is low and bare to Point Hibbs, but then rises gradually to a height of several hundred feet near Port Davey. Off the rocky and dangerous south coast is Maatsuyker lighthouse, visible 25 miles.

The south coast is a fine example of a drowned coast-line. Bruni Island (27 miles long) is a submerged ridge, the original valley to the west forming D'Entrecasteaux Channel. Small towns largely engaged in fruit-growing—Ramsgate, Hythe, Folkestone, Franklin—lie on its western shores, and there are many timber mills in the hinterland, especially along the Huon River. The island rises to 2000 feet, and is densely wooded; the light at the south-western point (Bruni Head) is visible 22 miles. Storm Bay, between Bruni Island and Tasman Peninsula, receives the Derwent River, on whose estuary stands Hobart, immediately at the foot of Mount Wellington. The largest steamers can berth here, and there is direct and regular communication with the other States and with New Zealand and London. The chief exports are wool, grain, timber, hops and fruit. Newtown and Glenorchy are suburbs of Hobart; across the estuary lie Risdon and Bellerive. The river is navigable to New Norfolk. Frederick Henry Bay, an inlet at the head of Storm Bay, leads to Sorell and Norfolk Bay, and almost isolates Tasman Peninsula. This picturesque district terminates in Cape Pillar, a cliff over 900 feet high formed of basalt columns; on its southern coast is Port Arthur, the old convict settlement, and it is connected with the mainland only by Eaglehawk Neck (which is only 20 yards wide at high

tide) and East Bay Neck, through which at Dunally there is a canal big enough to take small vessels. Maria Island is a granite outcrop halfway between Tasman and Freycinet peninsulas. The latter, with Schouten Island at its southern end, encloses Oyster Bay, on which stands Swansea. Thence the coast trends due north, and is cliffy as a rule, but there are small flats at Bicheno, Falmouth and St. Helens.

Rivers and Lakes.—Most of the rivers have been mentioned above, but a few merit further description. The South Esk, the longest (160 miles from source to sea), rises within a few miles of the coast, behind St. Marys. In its basin are Fingal, Longford and Perth. Its principal tributary is the Lake River, which rises on the plateau in an indefinite divide where the Shannon also has origin; the Macquarie, a tributary of the Lake River 73 miles in length, flows through Ross and Campbelltown. A little farther north the Meander comes in from the west; the farming towns of Deloraine and Westbury are in its valley. At Launceston the North Esk joins the South Esk, and their united stream, called the Tamar, enters Bass Strait 40 miles northwards.

Of equal importance with the South Esk is the Derwent (107 miles). It rises in Lake St. Clair in the west of the central plateau, which drains into it through the Nive, Dee (from Lake Echo), Ouse (whose tributary the Shannon comes from the Great Lake) and Clyde (from Lake Sorell). Another tributary, the Jordan (58 miles), flows through comparatively populous districts east of the plateau; in its valley are Oatlands, Kempton, and Brighton. Hamilton and Bothwell on the Clyde, and Glenora on the Derwent itself, 10 miles above New Norfolk, are settlements of some importance.

The peculiar physiography of the Ouse and Shannon has led directly to the development of the only large hydro-electric plant yet established in the Commonwealth. The Ouse runs just west of the Great Lake, gradually cutting its way into the plateau until a deep valley is formed. The Great Lake, which had formerly an area of 42 square miles, is drained by the Shannon, whose canyon begins lower down. A little south of the lake there is a difference in level of 1250 feet between the Shannon and the parallel course of the Ouse, only 3½ miles away. A dam has been built at the lake, which increases its area to 50 square miles; the head of water thus established is utilized in a way fully described under HYDRO-ELECTRIC DEVELOPMENTS.

Population.—There are three centres of population in the State—Hobart, Launceston, and the north-western mining district. About 50 per cent of the population live round Launceston and along the north coast, about 40 per cent round Hobart and in the south-eastern districts; the rest are in the mining division. The south-west is almost entirely uninhabited; the three large counties of Lincoln, Franklin, and Montgomery only contain 327 persons between them, and Arthur has none. These sparsely inhabited regions consist largely of bleak granite plateaux, or an almost impenetrable jungle of temperate rain-forest. There are, however, timbers of economic value which will lead to settlement later.

Products.—Only about two per cent of the *sheep* in Australia are reared in Tasmania; the number has remained almost stationary for 50 years. Sheep are congregated chiefly in the uplands between Hobart and Launceston—especially near Bothwell, Oatlands, Hamilton, and Campbelltown—but some are found in all settled districts. Tasmanian stud sheep are valued by mainland flock-owners. The wool-product for 1922-23 was 10,218,550 lb. *Cattle* form only 1½ per cent of the total for Australia. About one-third are dairy cattle, largely distributed along the north coast, where 70 per cent of the butter factories are clustered round Stanley, Wynyard, and Ringarooma. For other cattle King Island in Bass Strait and the Derwent valley near Hamilton are important areas. Dairies exist chiefly in the lowlands that receive from 30 to 50 inches per year; other cattle prefer the rougher country of the central and Ben Lomond districts.

Wheat is of much less importance than oats, and the output is diminishing. The two chief regions are near Longford and Westbury in the north, and Brighton and Richmond in the south. *Oats* are grown in the dairy country to a much greater extent than wheat. The chief centres of production are Devonport, Ulverstone, and Burnie on the coast, and Longford inland. Sheffield, Deloraine, Wynyard, and Westbury in the north, and Oatlands in the south, are also important districts; but oats are grown throughout the eastern portion of the State. The two outstanding fruit-crops are apples and raspberries. Out of two million bushels of *apples* grown in 1915 more than three-quarters came from the vicinity of Hobart. The chief centres are Franklin and other places at the mouth of the Huon, Kettering, New Norfolk, Brighton and Glenorchy. *Pears* are similarly distributed. *Raspberries* are grown from New Norfolk to Franklin. Eighty per cent of the large *potato* crop comes from the north coast, chiefly in the vicinity of Sheffield, Ulverstone, and Wynyard. Oatlands, New Norfolk, and Richmond are the centres of the less important southern area.

Considering its small area, the State has an important *timber* industry. Over 45½ million super feet were sawn in 1922. The whole State, except the plateaux, is more or less covered with forests, especially along the west and south coasts. In the east the trees are eucalypts, but a different growth—due to the extremely heavy rainfall—obtains in the western and Ben Lomond districts. Wherever the rain exceeds 50 inches per annum, the eucalypt is replaced by the evergreen beech (*Nothofagus*); there are also valuable areas of softwood pines. The blue gum (*Eucalyptus globulus*) and stringy-bark (*E. obliqua*) are perhaps the chief hardwoods; blackwood (*Acacia melanoxylon*) is an ornamental wood. All these grow to larger proportions than on the mainland. The chief sawmills are on the lower Huon and near Hythe; but an area of great importance lies north-east of Launceston, round Lilydale and Scottsdale.

As a *copper* producer the Mount Lyell district is second only to Cloncurry in Queensland, about 1500 men being employed; the mining towns of Queenstown and Gormanston communicate by rail with Strahan and Pillinger on Macquarie Harbour and with Burnie on the north coast. For *tin* there are two centres. The mines now most productive occur along the Ringarooma River at Pioneer, Gladstone, and Branxholm, but the famous Mount Bischoff mines, at Waratah in the north-west, are still giving large yields. Important *silver-lead* deposits occur at Zeehan, halfway between Mount Lyell and Waratah; Mount Farrel and Mount Magnet also have valuable silver-lead deposits. The *gold* output has been gradually decreasing in value since 1899, the quantity pro-

duced in 1922 being 3431 fine oz. Beaconsfield mine is the chief producer; Matthina in the north-east has nearly as large a yield, and even more gold is recovered from the copper of Mount Lyell and allied mines. There are three series of *coal* measures. The Permo-Carboniferous measures are worked to a slight extent near Latrobe on the Mersey. The Mesozoic deposits cover a large area of the State, though much faulted by basic lava intrusions. The Tertiary (brown coal) deposits are widespread, but are hardly exploited at all. Almost all the State's coal is derived from the St. Marys district, the chief mines being at Cornwall and Fingal. W. H. Twelvetrees estimates that there are about 68 million tons available in these two formations; but neither type equals the Newcastle series, as they are higher either in sulphur or in ash content. See PHYSIOGRAPHY and GEOLOGY.

Gr.T.

Geology. 1. *Introduction.*—An observer taking a bird's-eye view of Australia and Tasmania would see the great island continent carpeted nearest the coast with strips of dark-green eucalypt forest on the E., SE., and N., and again in the SW. part of Western Australia, with an outlying strip upon the Flinders Range of South Australia. The remainder would present a curious patchwork, partly dull green sagebush, saltbush, and other salsolaceous herbs of the steppes; partly the grasses of the savannahs, and the dark-green mulga scrubs; and partly patches of red and brown sand (the desert areas) dotted with oases which fringe the worn-down stumps of ancient inland mountains.

White specks in numbers would be conspicuous in this patchwork wherever the saline surfaces of dead lakes (playas) reflect the sunlight, or where—except in late summer—the highlands of New South Wales and Victoria are white with snow. The emerald isle of Tasmania, the S. coast of South Australia, the SE. coast of Victoria, and (in places) the inland uplands of tropical Queensland would appear jewelled with lakes. To the north the great island of New Guinea would loom large, its alpine ranges whitened with snow, its mountainous uplands—where visible through breaks in the mist—showing verdant, grassy slopes encircled by sombre pines and cypress. Lower still would be seen the dense dark-green jungle of the coastal plains.

Australia is well known as the home of the eucalypt, and this characteristic tree is in itself an epitome of climatic conditions in late geological time. The most primitive types of eucalypt develop their leaves with the broad surface horizontal, pointing to a time when there was no need to take special precautions to conserve moisture. In the vast majority of eucalypts, on the other hand, the leaves hang with their broad surface vertical, so as to offer as little evaporating surface as possible to the sun's rays; but even these in early stages of growth show the atavistic tendency to develop leaves with the broad surface horizontal

This habit connotes a former better rainfall, and this in turn suggests a former higher relief for the Australian land-surface, inducing a more abundant convectional rain. Thus the eucalypts record the most recent climatic changes of Australia, and prepare us for those evidences of peneplained and downward-warped mountain chains, with recently uplifted coast-lines, that harmonize with its large, disintegrated drainage system. This disintegration of the drainage, again, harmonizes with the shallow, wide-bottomed valleys, choked with rock debris; with the vast red-soil plains; and with the kunkars, laterites, 'pindan' ironstones, and porcellanites, so characteristic of the interior of Australia, as of all countries where rainfall is scant and evaporation great. But these inland areas of low rainfall do not lack the rich plant-foods which have accumulated during the sabbatical periods of drought, as is proved by the inland extension of the wheat-belt through methods of dry farming, and the consequent contraction of the central waste areas.

In countries of low rainfall (ten inches or less annually) and with very few rainy days throughout the year, the capillary action of percolated rainfall in the soil and subsoil and underlying rock greatly predominates over the leaching action of the rainfall. The sparse rains, for a few days in the year, tend to wash soluble mineral matter from the surface to deeper levels, but during each of the (perhaps 350) dry days in the year evaporation at the surface of the ground induces a constant upward flow by capillarity of subsoil water with mineral matter dissolved in it. Further evaporation leads to this mineral matter being deposited as a hard superficial crust, from two to ten feet in thickness. If the dominant soluble mineral in the underlying rock is lime, a surface crust of tufaceous limestone (nodular kunkar) forms; if iron is the dominant soluble mineral, laterite and pisolitic ironstone (pindan ironstone) result; if silica, the surface of the ground becomes enriched in silica, and porcellanites and quartzites result. These siliceous crusts become disrupted through the great diurnal changes of temperature in the interior of Australia, and form vast sheets of angular blocks like freshly broken road metal. The 'gibber' plains of central Australia owe their origin to this process.

2. *Coastal Physiography.*—A glance at the map explains some of the chief reasons for the shape of the Australian coast. The chief coastal indent—the Gulf of Carpentaria—is to be correlated with strong tectonic lines, approximating to a meridional direction, which determined the position of the northern end of the Cretaceous basin. The dominant folds in Arnhem Land, on the W. side of the Gulf, are parallel to its shoreline; the folds in the Palaeozoic rocks of the Cape York peninsula are approximately meridional with a very heavy downthrow at the trough of the Little River coal-field. The southern shore of the Gulf seems related to the WNW.-ESE. fold axes which run through the Etheridge and Gilbert goldfields. The Great Australian Bight, again, appears to be of tectonic origin, lying between the old fold-mountains (recently block-faulted) of the Mount Lofty and Flinders ranges near Adelaide, and the vast peneplain of Western Australia, with its worn-down folds, shaped in plan like an inverted S.

The two deep indents—Spencer Gulf and St. Vincent Gulf—are clearly 'senkungsfelder,' the southern end of a great rift valley which extends by way of Lake Torrens (92 feet above sea-level) to Lake Eyre (about 60 feet below sea-level). Bass Strait, as shown by the geological evidence, is another rift valley crossing the older grain of the country, and so is the depression in which lie Torres Straits.

A fall in sea-level to the extent of about 200 feet would re-unite Tasmania and Australia, and a fall of only about 100 feet would re-unite Australia and Papua. This could also result from a negative 100-foot movement of the ocean, such as probably occurred towards the

culmination of the latest ice age; then the sea-level in temperate and subtropical latitudes was probably 100 feet lower than at present, owing to the locking-up of water to form the great ice-sheets.

Cape Leeuwin and Cape Naturaliste are certainly due to a heavy coastal trough-fault just E. of them, which in that SW. part of Western Australia has determined for a great distance the trend of the western coast-line. Hobson's Bay (Port Phillip) south of Melbourne is probably on a meridional rift valley; the Hunter valley and the port of Newcastle are situated on a NW. to SE. rift valley. That whole section of the Queensland coast which for 1200 miles NNW. from Rockhampton runs parallel with the Great Barrier Reef owes its trend to powerful downthrows to the east, perhaps compensating for the epeirogenic movement of land to the west. The trend of the E. and W. shores of Tasmania is parallel to axes of folding. It is obvious that the S. coast of Australia (as well as the whole of its N. and NW. coasts) is of an Atlantic type. On the contrary, the SW. coast of Western Australia, the E. and W. coasts of Tasmania, and the NE. coast of Queensland are, as regards their trends, of a Pacific type. The SE. coast of Australia does not appear to be either wholly Atlantic or wholly Pacific; the term 'sub-Pacific' has been suggested for it.

As regards geological structure, the Australian coast at Fremantle consists of recent dune rock cemented by lime, derived chiefly from remains of mollusca and *Lithothamnion*. Numbers of artesian wells, sunk in this rock near Perth, yield copious supplies of artesian water. Cretaceous rocks have been penetrated there at about 1000 feet below sea-level. Similar calcareous dune rock forms the coast at Cape Northumberland (South Australia), at Warrnambool (western Victoria), and at Sorrento, on the E. side of the entrance to Port Phillip; so far it has not been proved to carry artesian water.

From Cape Naturaliste to Cape Leeuwin the coast is formed of recent dunes resting on granite, while towards Albany a deeply indented coast of granite makes its appearance, with dunes lodging in the hollows. Close to Albany, and extending inland to the foot of the Stirling ranges, is a remarkable spongilite deposit of Janjukian (Miocene) age largely formed of sponge spicules. Farther eastwards, near Cape Riche, is a small basin of similar spongilite rocks, while near Cape Arid the coast is masked by the Recherche Archipelago, mostly ancient crystalline rock. East of Cape Arid to Fowler's Bay, in the direction of Eyre's Peninsula, the coast-line is formed of nearly perpendicular cliffs up to 250 feet in height, with a further gentle rise of about 290 feet inland towards the Nullarbor Plains. At the base they are formed of white chalky rock with layers of flints, the whole capped by polyzoal and molluscan limestones. At present the whole of this series is attributed to some time between Eocene and lower Miocene. About 900 feet below sea-level, at the Madura bore (W. of Eucla), the Tertiary limestone rests on a thick series of Cretaceous greensands with a well-preserved marine fauna. Along this 500 miles of unbroken coast-line, and along the extension of the coast farther eastward for another 500 miles from Fowler's Bay to the head of Spencer Gulf, there is not a single river. As the rocks inland are mostly porous Tertiary limestones, almost horizontal, there is no surface run-off of the rain-water, which sinks in swallow-holes to tortuous subterranean tunnels and is discharged below the foot of the sea-cliffs—as in the catavothra of Greece. From Fowler's Bay round the headlands of Eyre's Peninsula and the lower end of Spencer Gulf the coast-line is formed partly of Tertiary sediments, partly of pre-Cambrian schists, gneiss and granite—the last-mentioned well seen in the North and South Neptunes at the entrance to St. Vincent Gulf. A plain of erosion along the coast, part of a block-faulted peneplain, crosses Yorke Peninsula to the E. side of St. Vincent Gulf, and extends to the W. side of the Mount Lofty ranges. This coast is formed partly of post-Pliocene flood-loams (which N. of Port Augusta contain remains of the crocodile *Pallimnarchus pollens*), partly of richly fossiliferous Tertiary marine limestones, partly of Permo-Carboniferous glacial beds, and partly of the highly folded Cambrian and Proterozoic series with their glacial beds. For general interest and variety this part of the coast-line is probably unequalled elsewhere in Australia. The strand-line has here recently been raised 12 feet, and Port Adelaide and Port Wakefield are built on the land thus naturally reclaimed. Evidence of such an emergence can be traced round the greater part of Australia; it is probably due to a world-wide sinking of the sea-level. Kangaroo Island is formed of Proterozoic rocks, capped by Tertiaries and basalt at its eastern end. The Cambrian and Proterozoic rocks continue along the coast E. of Backstairs Passage to the mouth of the Murray River at Port Elliot. An upward movement of the land hereabouts has reclaimed the Tertiary basin which extends far inland from this part of the coast; the Murray and Darling Rivers have become engrafted, and the lower Murray has been rejuvenated, forming an antecedent stream entrenched in a well-marked canyon.

From the mouth of the Murray to Cape Northumberland the coast-line is mostly formed of loose dune sand, or consolidated dune sand like that of Cape Northumberland. The dune rock rests on marine Tertiaries, on recent alluvials of the Murray basin, or on small inliers of granite. Inland from Cape Northumberland are the recently extinct volcanoes of Mount Schanck, Mount Gambier, etc. From Cape Northumberland to E. of Warrnambool the coast is similar, with occasional outcrops of Tertiary sediments, capped by basaltic lava, until the Otway coast is reached. This is formed of freshwater Jurassic strata, in places containing small seams of coal.

East of the dune rock of Sorrento the Victorian coast is formed of Tertiary rocks and older basalt; then of the Gippsland coal-measures, in which the claw of a dinosaur and teeth and scales of *Ceratodus* have lately been discovered. At Cape Liptrap the cliffs are partly Silurian and partly Ordovician slaty rocks, while at Wilson's Promontory they are granite. Beyond Corner Inlet there follows to the NE. a long stretch of sands deposited in slack water between the southerly-flowing East Australian current and the current flowing easterly out of Bass Strait. This sand has engrafted many of the rivers, and formed the Gippsland lakes; the reclamation has probably been helped by a fall in sea-level. At Gabo Island and Cape Howe granites form a rückland coast, which continues (with the addition of Ordovician, Silurian, and Devonian sediments) to Moruya and Milton.

North of Milton the coast partakes more of the nature of a forland coast; a distinct coastal plain is developed from sediments of the Permo-

Carboniferous and Triassic basins, and continues N. for over 200 miles to Port Stephens. In its deeply indented estuaries, harbours, and drowned valleys (e.g. Jervis Bay, Port Hacking, Botany Bay, Port Jackson, Broken Bay, Port Stephens, etc.), and in the entire absence of marine Tertiary deposits, this part of the land shows evidence of recent sinking. From Jervis Bay to Wollongong the strata in the sea-cliffs are rich in Permo-Carboniferous marine fossils, while those of Bulli and the cliffs towards Newcastle, 100 miles to the north, show frequent coal-seams, and abound—especially near Newcastle—in Permo-Carboniferous fossil plants.

From Port Stephens to near Grafton the coast is mostly of an indented type, with drowned valleys between hills coming close to the coast, numerous bar harbours, and a narrow coastal plain fringing Carboniferous, Devonian, and probably Ordovician strata. An outlying part of an immense belt of serpentine, intrusive into middle Devonian radiolarian rocks, touches the coast at Port Macquarie. From the Clarence River to the Richmond there is a forland coast of Jurassic coal-measures—the Clarence basin. A low, indented, rückland coast—again of Ordovician strata, cherts, tuffs, and quartzites, capped by alkaline basalts and acid pitchstones—stretches from Ballina to near the mouth of the Brisbane River. A forland coast, in part Jurassic, stretches from the Brisbane River to Gladstone. Interesting volcanic rocks (comendites and riebeckite trachytes, together with alkaline andesites and basalts) form conspicuous domes and sugar-loaves a short distance inland from the coast, which is there fringed with dunes—the largest in Australia—up to 800 feet high. At Maryborough and Great Sandy Island marine Cretaceous rocks outcrop, with a basin of productive coal (the Burrum Basin, the only deposit of Cretaceous coal worked within the Commonwealth) immediately overlying them. From Gladstone to Cape York there is a remarkable coast, chiefly of the rückland type, with mountain ranges from 2000 up to 5000 feet high (Bartle Frere 5438 feet) coming mostly close to the coast-line, and having high islands like Hinchinbrook (3560 feet) close inshore. This part of the coast and coastal shelf is so heavily faulted, and studded with small islands that have survived the block-faulting, as to deserve Suess's title of 'panzer-horst.' In some places there is a coastal plain, e.g. at the Cretaceous coal-basin of Broad Sound, at Port Mackay, and NW. and SE. of Townsville North; in others the old rocks (chiefly Carboniferous strata with *Lepidodendron* and *Phillipsia*, or Devonian rocks with massive coral and stromatoporoid limestones, both systems intruded by granites) form bold cliffs and headlands. This remarkable part of the coast-line is opposite to the Grand Canal of Australia, which runs between the Great Barrier Reef and the mainland. The high coastal hills are obviously part of the old main divide, its eastern slope with nearly all the easterly-flowing rivers being faulted eastwards under the Barrier. This coast terminates in granite, capped with the horizontal upper Cretaceous desert sandstone that forms Cape York. From Cape Howe to Cape York, a distance of 2150 miles, marine Tertiary deposits are wholly unknown. From Cape York round the rocks of the Gulf of Carpentaria the coast is of a low, forland type, at first formed of desert sandstone, then of late Tertiary and post-Tertiary freshwater deposits, with an inner zone of marine Cretaceous rocks. It is thought that the submarine outlook of the northern part of the great artesian basin lies somewhere towards the southern shore of the Gulf of Carpentaria.

On the W. side of the Gulf are numerous islands, formed of Permo-Carboniferous rock. A short distance inland from the mouth of the Roper River the late Cainozoic sediments give place to Cambrian sandstones and limestones, the latter on the Daly River being largely formed of *Salterella hardmani*. These limestones, many thousand feet thick, rest on an older volcanic series. From here to Darwin the coast is formed chiefly of Cretaceo-Tertiary and Permo-Carboniferous rocks, with an occasional low-lying outcrop of older Palaeozoic or pre-Cambrian rock. Proofs of recent uplift of the land are everywhere evident, except between Arnhem Bay, the English Company's Islands, and Cape Arnhem, where there appears to have been a recent downward movement. Elsewhere upraised post-Tertiary muds, with echinoderms and crayfish and banks of dead coral, are clear proofs of recent uplifts. One of the most beautiful parts of the whole Australian coast is the north-eastern extremity of Arnhem Land. Tectonic disturbances, present as major faults running NE. and SW., are crossed by minor faults throwing NE. At Point Charles lighthouse, near Darwin, rolled specimens of *Ammonites* and *Scaphites* occur in great numbers. At Port Darwin the coast is composed of whitish shales and sandstones, containing numerous casts of *Belemnites*, and in places consisting almost entirely of radiolaria. These were originally deposited at a considerable depth—which suggests that since upper Cretaceous times (the epoch to which these rocks belong) there has been an equivalent upward movement of this coast.

3. *Palaeogeography and Present Relief.*—The photographs of the relief-model of Australia and Tasmania show the broad physical features of the Commonwealth, while the orographic map gives the actual contour-lines, and the tectonic map the chief trend-lines. These maps, together with the sections, show that Australia is essentially a vast peneplain. This has been in part abandoned by the ocean, in part warped upwards or downwards in arches and compensating troughs; and the warping has been accompanied by heavy fractures. The latest of the true fold-mountains dates back to Carboniferous time; for, although in eastern Queensland the Permo-Carboniferous rocks are steeply tilted, they are never closely folded as the Carboniferous rocks often are. Great peneplanation took place in Permo-Carboniferous time, followed by a considerable transgression of the sea in a wide belt sweeping inland on either side of Sydney, then swinging N. through Queensland at least as far as Townsville. In Triassic and Jurassic time Tasmania, Bass Strait and southern Victoria were covered by great lakes and swamps, in which the coal-measures of that age were formed. Contemporaneously a vast lake stretched from at least as far E. as Brisbane more or less continuously to Lake Eyre, a distance of nearly 1000 miles. It is not known yet how far this lake stretched meridionally, but it must have been at least 500 miles. Gondwana Land was probably still in existence, as far as can be judged from the evidence available in Australia, India, New Zealand, South America, and Antarctica. In late Jurassic or post-Jurassic time there supervened gigantic intrusions of diabase (dolerite), on a scale perhaps unprecedented in geological history; these took the form of sills, which dominate the physical features of Tasmania, the Kar-

RELIEF MODEL OF AUSTRALIA AND TASMANIA
The black portions show low-level plains

RELIEF MAP OF AUSTRALIA AND TASMANIA, SHOWING TREND LINES

roo, Antarctica, and British Guiana. It seems highly probable that these intrusions were connected with the sinking-in of Gondwana Land, the consequent compensating warping-up of the sea-floor, and probably a further shallowing of the sea-floor through submarine extrusions of the dolerite; and the same phenomenon may account for those world-wide transgressions of the oceans in Cretaceous time which Suess considers one of the most conclusive pieces of evidence for occasional rises in sea-level. Australia was no exception to the rule that epicontinental seas of vast size transgressed all the world over in Cretaceous time. During the older Cretaceous (Rolling Downs) series the portion of the continent which is still preserved was severed by a sea stretching from the Gulf of Carpentaria to the Bight. The marine fauna of this sea is essentially that of a local Mediterranean. On the other hand, the Cretaceous rocks of the W. coast of Western Australia have a cosmopolitan Cretaceous marine fauna, closely resembling that of India. Thus the old land barrier which united eastern Australia with India in Permo-Carboniferous (Permian) time does not seem to have been wholly broken down in early Cretaceous time. In upper Cretaceous time marine conditions were largely replaced by lacustrine, lake-surfaces (with small marine basins here and there) covering about half of the whole Australian area. During this period was deposited the so-called desert sandstone, which at one time probably covered about three-quarters of Queensland, one-third of South Australia, and at least one-fifth of New South Wales.

In early Miocene time a considerable portion of southern and north-western Victoria, part of north-western Tasmania, the extreme south-western corner of New South Wales, a large area round St. Vincent and Spencer gulfs, and a still larger area at the head of the Bight, were submerged. It is important to note that the submergence crept inland at least as far as the surface of the peneplain at Lake Cowan, near Norseman in Western Australia, where deposits of marine sponge-spicules are superimposed on the peneplain. Marine molluscan remains, apparently of Janjukian (Miocene) age, have also been found resting on this old peneplain. The vast peneplain of Western Australia and the Northern Territory, and possibly that of eastern Australia as well, are approximately of the same date.

It has been argued that the Australian and Tasmanian peneplain survived without serious warping into Pliocene time. This provisional conclusion is based on the uniform character of the Pliocene flora—as far as the few fragments of it that are preserved allow us to judge—which may be due to the fact that at this time the land over large areas was reduced nearly to sea-level. That some warping of the peneplain had commenced, probably as far back as the Oligocene, is proved by the fact that in Victoria the so-called 'older basalts,' (of perhaps Eocene or Oligocene age) are capped by the lower Miocene marine beds; and there is evidence to show that Tasmania, after being joined to Australia in early Tertiary times, was divided from the mainland by a strait in middle Tertiary or early Pliocene time, and then re-united or nearly re-united in late Pliocene or Pleistocene time. The Tasmanian aborigines, ignorant of the building of sea-going canoes, were thus able to migrate into Tasmania from the mainland. That the warping of the Australian and Tasmanian peneplain was chiefly post-Miocene is proved by the locally folded and uplifted lower Miocene beds in the Mount Lofty ranges, near Adelaide. Also the latest great outburst of volcanic energy all over Australia (the Northern Territory excepted) took place in post-Miocene time. Moreover, the glaciation of the Tasmanian highlands, and of those of SE. Australia, took place in late Pliocene or Pleistocene time; and these glaciations were almost certainly contemporaneous with accentuated crust-warping, though it is not intended to suggest that there was necessarily a causal connection between the two phenomena (there possibly may have been). Next, the existence of abundant remains of large herds of Pliocene or Pleistocene marsupials —some of elephantine proportions—in what are now low-lying arid regions, along with the discovery of remains of the late Pliocene or Pleistocene crocodile, *Pallimnarchus pollens*, as far south as Lake Torrens near Port Augusta, demands a higher rainfall, moister climate, and probably higher relief for the interior of Australia than it at present possesses. Then too, the canyons of the upper Flinders, of the eastward-flowing New England rivers (the Macleay, the Hastings, etc.), and of the Blue Mountain rivers, the Shoalhaven River, etc., imply that no very great time has elapsed since the warping; otherwise some of the valley walls would be flared down and reduced to gentle slopes.

All over the highlands of Tasmania, as well as over the Kosciusko plateau, there is evidence of a succession of glacial epochs. These were perhaps synchronous with the recent maximum glaciation in Antarctica and in South America—possibly with the phases of the Great Ice Age in the northern hemisphere.

Amongst the newest of the tectonic movements has been the development of the great tensional faults which have so strongly block-faulted the Flinders Range and the main eastern divide, especially along the Barrier Reef area—where, as in the neighbourhood of Cairns, the upper end of the Barron River is left hanging on the upthrow side of the fault-block. The fault which bounds the Darling Ranges of Western Australia on the west is probably a development of late Pleistocene time.

4. *Stratigraphical Features.*—The geological succession in Australia may be indicated as follows:—

Post-Tertiary group. *Recent* system (duration about 20,000 years): (1) River alluvium and sand dunes, with hard calcareous dune rock. Aboriginal kitchen middens. Laterites ('pindan' gravels and nodular ironstone). Nodular tufaceous limestone ('kunkar'). Salt deposits and muds of the 'playas.' Active crater of Mount Victory in Papua; recent craters of Mount Gambier (South Australia), Tower Hill near Warrnambool (Victoria). The Great Barrier Reef of Queensland. Maximum thickness of dune rock 1000 feet. (2) Raised beaches, mostly 15 feet above sea around Australian coast. In Papua recent coral rock extends up to 2000 feet above sea-level. Submerged peat beds about 100 to 200 feet below sea to N. of Sydney. (3) *Helicidae* sandstone of Bass Strait islands, and *Planorbis* limestone west of Cloncurry in Queensland. *Pleistocene* system (duration about 1,000,000 years): (4) Mammaliferous drift and old lake muds, with remains of *Diprotodon, Nototherium, Thylacoleo, Thylacinus, Sarcophilus*, together with *Pallimnarchus pollens, Megalania*

prisca, Genyornis, Canis dingo, etc. In places these deposits may date back to late Pliocene, contemporaneous with—(5) Glacial deposits of western Tasmania and of the Kosciusko plateau.

TERTIARY group (duration about 55,000,000 years). *Pliocene* system (duration about 6,000,000 years; approximate age 7,000,000 years): (6) Basalt sheets (thickness 300 feet) of the fissure eruptions in E. and SE. Australia and Tasmania, Kangaroo Island (South Australia), and Bunbury (Western Australia). These range from Pliocene through Pleistocene to Recent. Newer 'deep leads' of alluvial gold and tin in eastern Australia and Tasmania. Werrikooian marine series of Victoria. *Lower Pliocene* or *Upper Miocene* system: (7) Older marine Pliocene beds (thickness about 1000 feet) of Adelaide. Kalimnan marine series (thickness 150 feet) of Victoria. Possibly Launceston lake beds belong here. (8) Belt of alkaline lavas and tuffs (thickness 500 feet) from Coleraine to Springsure, about 1500 miles. Melilite and nepheline basalts of Tasmania. (9) *Ostrea sturti* beds (thickness possibly 100 feet) of the lower Murray River. *Lithothamnion* limestone of Hallett's Cove, Adelaide. *Miocene* (Janjukian) system (duration about 12,000,000 years; approximate age 19,000,000 years): (10) *Cellepora gambierensis* limestones, passing into chalk with flints (thickness 80 to 1000 feet) around the Bight. At Table Cape (Tasmania) the oldest Australian marsupial, *Wynyardia bassiana,* occurs in this formation; *Lepidocyclina* occurs in places. Plantagenet series, Albany; Carnarvon marine Miocene series, over 1000 feet thick (both these are in Western Australia). Purari lignitic and oil-bearing series (thickness several thousands of feet) in Papua, with abundant *Lepidocyclina.* (11) Older basalts and tuffs (thickness 200 to possibly 1500 feet) and the older 'deep leads' of Gippsland (Victoria), New South Wales, and southern Queensland. Much laterite and bauxite are associated with this series. (12*a*) Important brown coal series of Victoria, with fossil plants and lignites. At Morwell, in Gippsland, these lignites are 888 feet thick. (12*b*) *Oligocene* system: *Balcombian marine beds* (thickness 400 feet) in Victoria. Port Moresby radiolarian cherts, etc., in Papua.

MESOZOIC group (duration about 135,000,000 years). *Cretaceous* system (duration about 65,000,000 years; approximate age 120,000,000 years): *Upper Cretaceous.* (13) Winton series, partly Cretaceo-Tertiary, (thickness 100 to 1000 feet) mostly of freshwater origin, with occasional erratics and with thin seams of coal in places. The sandstone is occasionally marine, with *Rhynchonella croydonensis.* The Burrum and Styx River coal-measures of Queensland probably belong hereabouts: also the radiolarian shales with belemnites of Fanny Bay, and the ammonite beds, both of Port Darwin; and the greensands and calcareous rocks of Eucla, Perth, Gingin, Carnarvon, etc., in Western Australia. *Lower Cretaceous.* (14) Rolling Downs formation (thickness 2000 feet) chiefly glauconitic sands, and clays, with abundant foraminifera, *Maccoyella, Cytherea, Crioceras, Lamna, Belonostomus, Notochelone, Ichthyosaurus, Plesiosaurus, Aeschna flindersensis.* The *Alveolina* limestones of New Guinea may perhaps be referred to this horizon. *Jurassic* system (duration about 35,000,000 years; approximate age 155,000,000 years): *Upper Jurassic.* (15) Diabase sills (thickness 500 to 1000 feet) of Tasmania. *Lower Jurassic.* (16) Sandstones (thickness 1000 to 3000 feet) of the great artesian basin, with lignitic coal in places. At Leigh's Creek, south of Lake Eyre, a 47-ft. seam of brown coal in this series. Coal-measures of Gippsland and Cape Otway; Walloon series of Queensland, with mineral oil. *Taeniopteris spatulata* is specially characteristic, and cycadaceous forms like *Otozamites,* and *Pterophyllum. Alethopteris* is also abundant, and *Unio eyrensis* numerous. The claw of a dinosaur allied to *Megalosaurus,* has been found in Victoria, also fossil *Ceratodus.* In Western Australia and Papua marine Jurassic rocks occur, with abundant ammonites. Opal-bearing rocks of White Cliffs (New South Wales) may be partly Jurassic. Clarence coal-measures of New South Wales, possibly Rhaetic in part. Productive coal-measures (thickness 3000 feet) of Tasmania. *Phyllotheca* present with *Thinnfeldia, Alethopteris,* etc. *Triassic* system (duration about 35,000,000 years; approximate age 190,000,000 years): (17) Bundamba sandstones and Ipswich coal-measures in Queensland. Hawkesbury series in New South Wales, with abundant fossil fish and large undescribed labyrinthodonts. Contains occasional ostracods and foraminifera and abundant *Estheria.* Much red and green tuff at base of series.

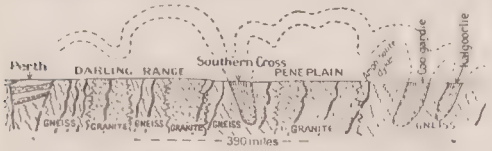
PALAEOZOIC group (duration about 360,000,000 years). *Permo-Carboniferous* (Permian) system (duration about 25,000,000 years; approximate age 215,000,000 years): (18) Acid granites of New England. Alkaline series of Kiama, New South Wales. (19*a*) Upper or Newcastle coal-measures (thickness 1500 feet) with 35 to 40 feet of workable coal. *Glossopteris* predominates over *Gangamopteris; Dadoxylon* abundant. The upper Bowen coal-measures of Queensland, and the Collie coal-field in Western Australia, are partly on this horizon. Dempsey series (thickness 2200 feet). Barren freshwater strata. Middle coal-measures (thickness 500 to 1800 feet), Tomago or East Maitland, about 18 feet of workable coal. Upper marine series (thickness 6400 feet), mudstones and sandstones, with abundant *Productus brachythaerus,* crinoids, 'glendonite' pseudomorphs, occasional glacial erratics in shales, and abundant *Fenestellidae.* Lower or Greta coal-measures (thickness 100 to 300 feet), with about 20 feet of workable coal. *Gangamopteris* predominates over *Glossopteris.* The Dawson and lower Bowen coal-measures (Queensland) probably belong here, as do the Mersey coal-measures of Tasmania and the Irwin coal-field of Western Australia. Lower marine series, with the Ravensfield sandstone and sodic basalts. *Carboniferous* system (duration about 85,000,000 years; approximate age 300,000,000 years): *Upper and middle Carboniferous.* (19*b*) The middle and part of the upper Carboniferous is represented in New South Wales by the Kuttung series, which contains acid and intermediate lavas and tuffs, with which are interbedded varve shales and tillites. In Victoria there are the Bacchus Marsh beds, over 2000 feet thick, with at least four beds of true tillite. At Wynyard in Tasmania, and Hallett's Cove near Adelaide, these tillites are very well developed. In Victoria and South Australia the tillites rest on beautifully striated pavements. In Western Australia a well-marked glacial horizon underlies the Irwin River coal-field. The *Achacopteris* beds of Victoria, the *Rhacopteris* beds of New South Wales, the *Aneimites* beds of Herberton and of Mount Budge in the Drummond Range, Queensland, probably belong to middle Carboniferous. (20) Sphene-granites of New England. (21) Bluegranites of New England. *Lower Carboniferous* (thickness 20,000 feet):

(22) Star series of Queensland, with *Lepidodendron australe, Aneimites,* and *Phillipsia.* The Burindi beds in New South Wales, with *Phillipsia, Productus semireticulatus, Syringothyris, L. volkmannianum, L. veltheimianum,* etc. In Victoria the Mansfield fish-beds and the Grampians sandstones may be included here, together with the fish-beds (with *Lepidodendron veltheimianum*) of the Drummond Range in Queensland. (23) Serpentine belt of New England, New South Wales. *Devonian* system (duration about 50,000,000 years; approximate age 350,000,000 years): *Upper Devonian* (thickness 10,000 feet). (24) *Spirifera disjuncta* quartzites of Mount Lambie, New South Wales, with *Lepidodendron australe.* Quartzites and red shales of Wellington and Twofold Bay in New South Wales, and Avon River sandstones of Victoria may belong here. *Middle Devonian* (thickness 9000 feet). Radiolarian cherts, reef limestones, and spilites of Tamworth, New South Wales. Burdekin series of Queensland, with reef limestone up to 7000 feet thick, an ancestor of the Barrier Reef. Buchan and Bindi limestones of Victoria, with andesites. Devonian rocks of Kimberley, Western Australia. *Lower Devonian* (thickness 14,000 feet). Murrumbidgee series, New South Wales, with *Receptaculites* and bony-plated fish-like *Asterolepis,* also a thick series of acid to intermediate lavas. In Victoria are the series of acid lavas and tuffs, the Snowy River porphyries. Dacites, quartz-porphyries, and granodiorites of this age occur in Victoria. Most of the granites of Tasmania are thought to be Devonian. Devonian rocks occur in Papua. *Silurian* system (duration about 40,000,000 years; approximate age 390,000,000 years): (25) Shales, sandstones, limestones, contemporaneous tuffs (thickness 3000 to 5000 feet). The type area is Yass in New South Wales. *Hausmannia* and *Encrinurus,* with the corals *Rhizophyllum* and *Mucophyllum* and *Pentamerus knightii,* are characteristic. At the base of the series is *Halysites* in great abundance. At Lilydale in Victoria, Chudleigh in Tasmania, and Chillagoe in Queensland, limestones of this age are well developed. They are frequently associated with radiolarian cherts. The west-coast conglomerates of Tasmania belong here. *Ordovician* system (duration about 90,000,000 years; approximate age 480,000,000 years): (26) These rocks (thickness possibly 9000 feet) are either littoral, like the Tempe Downs beds (south of the Macdonnell Range), with *Asaphus* and *Endoceras* abundant; or of the Victorian type—black shales, sandstones, graptolitic shales, with some sponge spicules, phosphatic slates, and cherts. They are also developed in New South Wales at Tallong, Mandurama, etc. The Brisbane schists and phosphatic argillites of Gladstone, Innisfail, etc., in Queensland may belong here. *Cambro-Ordovician* system: (27) The porphyroid series with breccias, tuffs, Dundas slates, etc., of western Tasmania. *Cambrian* system (duration about 70,000,000 years; approximate age 550,000,000 years): (28) This system (thickness possibly 10,000 feet) is chiefly developed in South Australia, and in the Northern Territory. The diabases and *Protospongia* cherts of Kilmore and Heathcote, and diabases, tuffs, etc., of the Hummocks, Dookie, and Mount Wellington in Victoria are probably upper Cambrian. In the Northern Territory thick sandstones overlie massive *Salterella* limestones, perhaps 7000 feet in thickness—another forerunner of the Barrier Reef.

PRE-CAMBRIAN group. *Proterozoic* system (age about 1,125,000,000 years): (29*a*) Beneath the above fossiliferous limestones is a vast thickness of basalts and basic tuffs, red shales, quartzites, thin limestones, etc. (Adelaide and Nullagine series). About half-way up in this series in South Australia are tillites up to about 1000 feet in thickness. (29*b*) The mosquito series of the Pilbara goldfield in Western Australia is a schistose group unconformably underlying the Proterozoic Nullagine series. At Kalgoorlie the Kurrawang conglomerates are probably Proterozoic, as are those of Goat Island (Tasmania) with mica schists; in the Mount Lofty and Flinders ranges the rocks of the Houghton magma, so rich in titaniferous iron and diopside, and connected with radium deposits, are also probably Proterozoic. The Casterton gneisses and schists of Victoria may also be Proterozoic, as well as most of the mica and quartz schists of the Northern Territory, and Cloncurry in Queensland. *Archaeozoic* system (age about 1,400,000,000 years): (30) Archaeozoic rocks are widely spread in Western Australia at Pilbara and most of the other goldfields, in the Musgrave and Macdonnell ranges, at Port Lincoln, etc., in South Australia, and over large areas of the Northern Territory.

Pre-Cambrian System.—The rocks of this age, comprising both Proterozoic and Archaeozoic formations, are developed on a particularly grand scale in Western Australia, South Australia and the Northern Territory; in fact about one-third of the whole area of Australia (approximately 800,000 square miles) is occupied by this vast crystalline complex. Pre-Cambrian rocks are developed in the Kimberley goldfield of Western Australia as well as at Darwin, and extend from the latter at intervals to Cloncurry in Queensland. In New South Wales they are represented by a belt of garnetiferous mica-schist, with amphibolites and gneiss, in the Barrier ranges of the Broken Hill silver-field. They are represented by schists near the Cobar copper-mines of New South Wales, and possibly by a thick series of crystalline schists in a broad belt of country stretching SSE. from Wodonga and Tallangatta through Omeo and Tongio West in north-eastern Victoria. The gneisses and schists of Casterton in Victoria, and the serpentine of Mount Wellington and a well-marked belt of mica-schist and white saccharoidal quartzite together with quartz conglomerates in Tasmania, are ascribed to this group. All the pre-Cambrian rocks of Tasmania appear to have been of sedimentary origin. In Western Australia at least three groups are present: (*a*) Archaeozoic older gneisses and greenstone schists (and jaspilites) with intrusive granite and pegmatite veins with numerous dykes of diorite, norite, dolerite, etc.; (*b*) Proterozoic rocks formed of coarse conglomerates together with phyllites, quartz-schists, etc.; (*c*) the Proterozoic basic and acid lavas and tuffs, red and black shales, quartzites, and laminated dolomites of the Nullagine series. Its basal conglomerate contains diamonds. The Stirling ranges of Western Australia may be of Nullagine age or older. The principal goldfields of Western Australia—one of which alone (Kalgoorlie) has produced to date over £100,000,000 worth of gold—are situated in rocks, probably of the first group, occupying deeply infolded basins, partly of pre-Cambrian basic lavas and tuffs, in the intrusive acid complex. The section on p. 534 shows these pre-Cambrian rocks to have been intensely folded, the trend of the folds being nearly meridional, but on the whole having the form of a very open inverted letter 'S.'

One can distinguish at least four of these great gold-bearing basins from east to west in the following order:—Kanowna, Boulder and Kal-



Diagrammatic Sketch, Perth to Kalgoorlie.

goorlie, Coolgardie, and Southern Cross. In the Pilbara district of Western Australia there is a considerable development of minerals of the rare earths, associated with veins of pegmatite traversing pre-Cambrian rocks; e.g. the tantalite (associated with tin-stone) found in this region occurs in sufficient quantity to control the whole of the tantalum market of the world. The mineral gadolinite, associated with well-crystallized monazite—and occasionally the rare radioactive mineral pilbarite, a lead-bearing uranium ore—also occur within this area. From the lead-uranium ratio it has been estimated that the age of these rocks is 1475 million years.

At Mount Painter (between the head of Spencer Gulf and Lake Eyre) the pre-Cambrian rocks comprise remarkably massive deposits with coarse mica-schists, containing an abundance of sapphire. These rocks are traversed by a huge lode containing radio-active minerals, such as monazite, torbernite, autunite, etc., together with a considerable amount of fluorspar. This lode has been traced along a continuous outcrop of over a mile, and in places is said to be over 20 yards in width—in places as much as 50 yards. At Radium Hill at Olary, on the railway line from Adelaide to Broken Hill, there is a considerable deposit of uranium-bearing titaniferous iron ore. At the surface outcrop this is stained lemon-yellow to orange by carnotite. The large deposits of haematite at the Iron Knob, Iron Monarch, Iron Baron, etc., south of Port Augusta in South Australia are of pre-Cambrian age. In the Macdonnell ranges, associated with the pegmatite dykes, are large crystals of muscovite mica, from 12 to 18 inches or more in diameter. Beryls in large crystals, but not of commercial value, occur in the same region. A remarkable rock in the pre-Cambrian group is that known as ribbon jasper. This rock, often many hundreds of yards in width, is typically a beautifully banded haematitic quartz rock. It can be traced for hundreds of miles along the gold-bearing belts of Western Australia as far north as Kimberley goldfield, and wherever reefs of quartz intersect it they are usually gold-bearing. Recent petrological research proves that this ribbon jasper is, in places, a mylonized quartz-dolerite, subsequently altered by silicification. It is singular that in other places (as at Boulder, near Kalgoorlie) a similar mylonized quartz-dolerite has been converted into a graphite-schist, possibly as the result of long-continued emanations of methane, which gas is still being evolved from the gold-telluride-bearing graphite-schists at the Great Boulder Proprietary mine. At Bimbowrie in South Australia magnificent crystals of chiastolite, used for jewellery, are abundantly developed in the pre-Cambrian rocks. To the east of the Mount Lofty ranges in South Australia there is a considerable development of andalusite-bearing schists, with which are associated schistose diopside-diorite. The latter rock is very rich in ilmenite, and black sands derived from this ilmenite are plentifully distributed throughout the basalt rocks of the succeeding Adelaide series. Pre-Cambrian rocks are also well developed in Eyre's Peninsula, where a series of dolomite limestones—the Hutchinson series—are intruded by granite-gneisses with pronounced contact metamorphic effects. The Willyama series of Broken Hill, consisting of sillimanite-garnet-gneisses and schists, granite-gneisses with amphibolite, and pegmatic dykes, is probably Archaeozoic. The Adelaide series (possibly lower Cambrian, probably Proterozoic) is remarkable for the development on a grand scale of glacial tillite. It has now been demonstrated that these glacial beds are in places fully 1000 feet in thickness, extend from the Sturt Gorge (east of Adelaide) at least as far north as Pekina (north of Port Augusta) and may extend almost to the tropic of Capricorn near Lake Eyre. The glacial beds of South Australia cross into New South Wales in the Barrier ranges about 20 miles north of Broken Hill. These beds are met with about half-way up in the 10,000 feet of strata of the Adelaide series.

Cambrian System.—Rocks of this age are developed on a grand scale in the northern part of the Northern Territory, as well as between Lake Eyre and Kangaroo Island. In the Northern Territory, in Arnhem Land, and in the Barkly tableland, the Cambrian rocks—there largely formed of limestones—have proved invaluable as a source of supply of sub-artesian water. These limestones at the Daly River in the Northern Territory (as well as at Mount Panton in the Kimberley goldfield) are rich in the fossil pteropod *Salterella bardmani*. Their thickness is certainly several thousands of feet, possibly 7000 feet. In Arnhem Land and at Kimberley these limestones overlie thick sheets of basic lavas, apparently belonging to the Proterozoic Nullagine series. *Archaeocyathinae* limestones are developed on a large scale at Yorke Peninsula, west of Adelaide, as well as near Normanville and the Onkaparinga Valley, whence they extend at least as far north as the Blinman and Ajax mines near Lake Eyre. They contain a rich and exquisitely preserved fossil marine fauna. It may be mentioned that small pieces of similar limestone were discovered in Antarctica by Sir Ernest Shackleton near Mount Darwin, about 360 miles from the south pole. In Tasmania Cambrian rocks (yellow rusty friable sandstones and quartzites) occur at Caroline Creek between Railton and Latrobe, as well as on the Humboldt Divide and in the Florentine Valley. These rocks, which contain well-preserved casts of *Crepicephalus*, are considered to be of upper Cambrian age.

The Heathcotian Series.—Shales and mudstones containing the trilobites *Dinesus* and *Notasaphus*, *Protospongia* and other sponge spicules, brachiopods and radiolaria, occur about three miles north of Heathcote. These were originally referred to the Cambrian, and later to the Ordovician age. Recent evidence tends to reinforce their Cambrian age. Immediately underlying these beds to the east comes a mixed series of black cherts, cherty shales, and igneous rocks—principally basic lavas, described as diabases, tuffs, and agglomerates, with a few minor dioritic intrusions and a larger intrusive mass of micro-granite. To these rocks the term Heathcotian has been applied. They have been described as underlying the *Dinesus* beds with marked unconformity, and have been referred to the pre-Ordovician and even to the pre-Cambrian series. Others have pointed out that there is no evidence of unconformity between them and

the overflowing Ordovicians, but there is evidence of a gradual passage; they cannot, therefore, be older than Cambrian and may be Cambo-Ordovician in age. Similar rocks, with similar stratigraphical relations, and containing black cherts with *Protospongia* and radiolaria interbedded with diabases, occur NE. of Lancefield. Probably the diabases and cherts of Mount Major near Dookie, of Mount Stavely, and of the Hummocks in the west of Victoria, and the tuffaceous series with limestones containing *Crepicephalus* and *Plectorthus* near Mount Wellington in eastern Victoria, are also referable to the Heathcotian series. In Tasmania the Porphyroid series of schistose quartz-porphyries, felsite tuffs and breccias, and spilitic basic rocks, of the Leven Gorge, and the Dundas slates, are presumably of Heathcotian, and therefore perhaps of Cambrian or Cambo-Ordovician age.

Ordovician System.—Two well-marked types—the one littoral, the other probably pelagic—are referred to this system. Shallow-water strata of the former type have been described from Tempe Downs station and the Levi Range, south of the Macdonnell ranges. These rocks show ripple-marks and sun-cracks, as well as cubical pseudomorphs in quartzite after rock-salt. Abundant well-preserved fossils, of which the commonest forms are *Orthis leviensis, Endoceras warburtoni* and *Asaphus illarensis,* are to be found in this neighbourhood in sandy calcareous shales. The other type of Ordovician rock (the dominant type, in fact) consists of black carbonaceous shales and slates, with bands of fine-grained sandstones and quartzites and occasional conglomerates. They are best developed in Victoria, where they are closely folded and strike generally in a NNW. direction. They are divided into a lower series in which the black shales and slates on the whole predominate, and an upper series in which sandstones are more prominent, and containing basal conglomerates, as at Kerrie, E. of Mount Macedon. The lower member has been divided by its graptolite zones from above downward into the Darriwil, Castlemaine, Bendigo, and Lancefield series. The most productive goldfields of Victoria—such as those of Poseidon, and Steiglitz—occur in lower Ordovician rocks, near intrusions of granodiorite. It has been suggested that the quartz reefs are generally most productive where traversing black shales of the Bendigo series. The lower Ordovician rocks have so far only been found in Victoria, and (with the exception of the Mornington Peninsula) only W. of a line running N. from Melbourne and stretching to the western boundary of the State. The upper Ordovician rocks are, on the whole, less closely folded than the lower series; they are also less auriferous, but have a generally similar NNW. strike, and occur only E. of a line running N. from Melbourne. Near Melbourne they occur at Diggers' Rest, and farther north at Kerrie. Inliers of upper Ordovician rocks occur near the Wood's Point goldfield, and also farther E., surrounded by the broad belt of Silurian rocks; while very extensive areas in eastern Victoria have yielded only upper Ordovician graptolites.

Northwards from Victoria the upper Ordovician rocks extend into New South Wales, sweeping in a broad belt E. of Mount Kosciusko, between the Snowy River and Cooma. A belt of the same rock has been identified at Tallong near Marulan. At Cadia near Orange there is a great belt of these rocks, containing contemporaneous andesite lava, with large deposits of iron ore. In Tasmania strata of Ordovician age, of the nature of black slates with very doubtful impressions of graptolites, may possibly be Ordovician.

Silurian System.—Strata of this age appear to be wholly restricted in the Commonwealth to the eastern portion of Australia and to Tasmania. In Tasmania they are well developed in the neighbourhood of the Mount Lyell mine, where they contain the trilobite *Homalonotus.* The strata in Victoria are divided into an upper (Yeringian) and a lower (Melbournian) series. At Lilydale there is a well-preserved marine fauna in the local limestones. These strata are not so strongly folded as those of the Ordovician system. Perhaps the richest fossil-bearing locality for the Silurian is to be found in the Yass district of New South Wales. The rocks there consist of contemporaneous dacite tuffs with sandy shales, olive-coloured to yellowish-brown shales, and numerous beds of limestones, which are built up of a rich coral fauna—obviously old fringing coral-reefs. One of the commonest and most characteristic corals is the mushroom-shaped form, *Mucophyllum. Pentamerus* is plentiful near the limestones in the middle system. *Halysites* is common and characteristic in the lower limestones of the system; at Spring Creek near Orange, and at Molong, it is the sole constituent of some coral-reefs. In the upper strata the trilobites *Hausmannia* and *Encrinurus* occur plentifully. The Jenolan Caves of New South Wales have been hollowed out of limestones rich in *Pentamerus.* In the limestone reefs at Wellington beautifully preserved siliceous sponges allied to *Astylospongia* are weathered out of the surface of the limestone. Silurian rocks so far have been identified in Queensland only in the neighbourhood of Chillagoe, where limestones containing *Halysites* are developed. At the same time it is considered probable that a belt of Silurian extends through Queensland, from the south of Boulia to the extreme north-west, and from 20 miles east of Cloncurry to the western boundary of the State.

Devonian System.—This is the oldest system in the Commonwealth in which definite fossil land-plants have been discovered; they give evidence of a great extension of the land-surface of Australia in an easterly direction since the close of pre-Cambrian time. They occur at intervals all the way round from Kimberley to Cloncurry as well as in the Burdekin basin, the Tamworth area, the region west of the Blue Mountains between Mudgee and Bowenfels (and a parallel strip near Wellington), Spring Creek near Orange, and Canowindra. They are also represented at the Yalwal goldfield, S. of the Illawarra district, as well as on a large scale at Burrinjuck and in the Pambula regions. Outlying patches of Devonian rock occur at Cobar, Oxley's Tableland, Gundabooka Mountain, and White Cliffs beyond Wellington. Southwards they can be traced into Victoria as the Snowy River porphyries, the Buchan and Bindi limestones, and the Tabberabbera shales. No undoubted Devonian rocks have as yet been proved in Tasmania, South Australia, or Western Australia south of Kimberley. The system is divisible into three series, the lower of which is often chiefly volcanic, consisting of banded rhyolites and tuffs associated with reddish-purple to chocolate-coloured shales. In places the volcanic rocks become basic. In the neighbourhood of Burrinjuck and higher up the Murrumbidgee River (near Taemas) there is a splendid development of folded lower or middle Devonian limestones.

A conspicuous and characteristic large fossil in these rocks is the form *Receptaculites*, and remains of large bony-plated fish, such as *Coccosteus* and *Asterolepis*, have been found in them. In Victoria the Buchan and Bindi limestones occupy eroded hollows in the surface of the Snowy River porphyries. The Grampian Range—of white, grey, red, and purple sandstones and conglomerates—perhaps belongs to the upper Devonian beds.

In New South Wales the Devonian is widely distributed, the major structure being a geosyncline which underlies the Permo-Carboniferous coal basin and outcrops along its margin NE. and SW. The numerous inliers and outliers in the western districts of this State have so far not received much attention. The area which has been most closely studied is that of the Tamworth district, where Benson has recognized upper, middle and lower Devonian rocks; the upper Devonian (Barraba) series comprises a thick series of radiolarian mudstones, tuffs and argillaceous limestones, which overlie the wonderful Baldwin agglomerates, in places 2000 feet thick. The middle Devonian comprises an upper group known as the Tamworth series, which contains radiolarian claystones with numerous specimens of *Lepidodendron australe*, and interbedded lenticular masses of coralline limestone—the curious coral *Sandidophyllum* is a dominant type on the Moore Creek horizon; and a lower group represented by a volcanic series containing spilites and dolerites, which overlies radiolarian cherts and claystones with interbedded tuffs. The lower Devonian (Woolomin) series is largely represented by phyllites and jasper beds, with which is interbedded a complex volcanic series. The whole Devonian series of this district probably exceeds 10,000 feet in thickness.

In Queensland the chief development of Devonian rocks is in the Burdekin basin. There they consist of very massive conglomerates at the base, passing upwards into coral-reef limestones of vast thickness (on the Burdekin River they are no less than 7000 feet thick); the most characteristic fossils are *Pachypora meridionalis* and *Stromatoporella*, with which are associated fossil plants such as *Dicranophyllum*, as well as a remarkable undescribed form. *Receptaculites* occurs at Mount Wyatt in Queensland. Upper Devonian rocks are mostly represented by reddish to grey quartzites, sandstones, and red shales. They are typically developed in New South Wales at Mount Lambie, Mount Walker, and Spring Creek near Orange, and are very rich in *Spirifera disjuncta* and *Rhynchonella pleurodon*. Lastly, at Kimberley there is a belt of marine Devonian rocks containing a fauna which suggests that it may be of middle Devonian age.

Carboniferous System.—Excepting, perhaps, the belt of rocks containing traces of rock oil at Kimberley, and the Grampians sandstones in western Victoria—which have yielded forms of *Lingula* and fish remains similar to those of the Mansfield rocks—no rocks of this age are known in Australia W. of a line joining Cape York with Melbourne. No trace of *Lepidodendron* has as yet been found in Tasmania. The system is widely represented in Queensland, where many of the folded highlands of the north-eastern coast ranges are built up of these rocks. The latest folding to which the earth's crust in Australia has been subjected belongs to late Carboniferous time. So far no marked unconformity has been traced between the Devonian and Carboniferous rocks. Rocks of true Carboniferous age in the Commonwealth are characterized by the presence in their lower strata of *Lepidodendron volkmannianum, L. veltheimianum* and *L. dichotomum*, and in their upper portion by several species of *Rhachopteris* and *Aneimites*. So far no single example of a *Lepidodendron* has been found anywhere in the Commonwealth in rocks of the so-called Permo-Carboniferous age, except in the Kimberley area of Western Australia. A marine fauna is associated with this system, particularly in its lower and middle portions. Important forms to distinguish Carboniferous rocks from the Devonian on the one hand, and the Permo-Carboniferous on the other, are *Phillipsia* and *Syringothyris*. So far no trace of trilobites has ever been observed in any of the true Permo-Carboniferous rocks. *Michelinia* and *Lithostrotion*, found in New England, are essentially Carboniferous forms, which never ascend into the Permo-Carboniferous systems. Less reliance can be placed on the brachiopods, many of which (such as *Productus semireticulatus, Orthis, Streptorhynchus*, etc.) ascend into the Permo-Carboniferous system.

The middle and partly upper Carboniferous (Kuttung) series is characterized by a vast thickness of lavas and tuffs, mostly acidic, such as rhyolites and ceratophyres associated with hypersthene andesites, hornblende andesites, and magnetite-sandstones. Intrusions of granite and quartz-porphyries occur on a grand scale in this system, and it may be assumed that the rhyolites and other acid lavas are the volcanic representatives of the granite batholiths. As regards local development, Carboniferous strata formed of reddish shales and sandstones are most typically developed in Victoria near Mansfield. They there contain *Lepidodendron veltheimianum*, with an abundance of fossil fish such as *Gyracanthides murrayi, Acanthodes australis, Eupleurogamus cresswelli, Strepsodus decipiens, Ctenodus breviceps, Elonichthys sweeti* and *E. gibbus*. The occurence of *Lepidodendron australe* in beds of undoubted Carboniferous age in the Star series of Queensland suggests that this widely developed series is, in part, upper Devonian; but the marine fauna is mostly lower Carboniferous.

In New South Wales the Carboniferous system, about 20,000 feet in thickness, extends in a wide folded belt from Port Stephens northwards into New England, reaching the Queensland border near the Horton River. It is best represented in the Hunter River district, where upper, lower and middle Carboniferous are recognized. The lower Carboniferous (Burindi) series consists chiefly of a thick series of marine mudstones, with some limestones and conglomerate, and a volcanic series. An abundant marine fauna is represented on certain horizons, and plant-remains such as *Lepidodendron, Ulodendron, Cyclostigma, Archaeocalamites* and *Pitys* also occur.

The middle Carboniferous (Kuttung) series is one of the most interesting and important in Australia. It consists of a thick volcanic series, interbedded with which are varve shales and true glacial tillites. The volcanic series is represented by hypersthene andesites, pitchstones and rhyolites, and tuff beds of similar character. In the Currabubula district the Kuttung series is intruded by sills of andesite, dolerite and ceratophyre. The chief interest, however, attaches to the glacial beds, for these are of

widespread occurrence throughout Australia. In the Hunter River district a wonderful series of varve shales occurs, interbedded with the volcanic series; these are often strongly contorted, and exhibit remarkable miniature folds. At Seaham tillite containing ice-striated boulders occurs on three horizons, which are interbedded with the varve shales. The lowest tillite bed is 200 feet thick. The whole glacial series is here about 1890 feet thick, a little more than half consisting of glacial deposits, and the remainder of tuffs and tuffaceous mudstones. At Webber's Creek (between Gosforth and Paterson) a striated pavement underlying varve shales has been discovered. The striations clearly show that the ice moved in a northerly direction. In Victoria there is a wonderful development of glacial beds of the nature of tillites, associated with contemporaneous conglomerates and ripple-marked sandstones, together with fine clay shales. These glacial beds lie on a surface of low relief, though in places (as at the Werribee gorge) the tillite fills an old U-shaped valley—perhaps an over-deepened valley. The rocks on which the tillite rests, mostly of Ordovician age with post-Ordovician granites, are very strongly striated and grooved by ice coming from a southerly direction. The sandstone beds between the tillites show strong evidence in places of contemporaneous contortion. As the matrix of the tillite varies with that of the subjacent rock, there can be no doubt that the tillite was formed by an immense sheet of land ice, the main mass of which lay to the south. These glacial deposits can be traced at intervals across Victoria northwards by way of Heathcote to Beechworth, close to the southern border of New South Wales; fine striated pavements can be seen at Derrinal, near Heathcote, together with erratics up to 30 tons in weight. Westwards they extend under the level plains of Tertiary rock, having been proved to underlie Nhill. To the south of Adelaide, between that city and the mouth of the Murray River, there are magnificent cliff sections showing the junction of the old glacial beds with the lower Cambrian strata. Beautiful striated pavements are to be seen in the Inman Valley, at Hallett's Cove, etc., which prove that the ice came from a south by east direction. The glacial beds are there, with their associated conglomerates, sandstones and shales, fully 900 feet in thickness. At Mount Grainger and Booleamatta there is an enormous development of these beds, possibly exceeding 5000 feet in thickness. So far, in South Australia as in Victoria, no productive coal or marine fossils have as yet been found over-lying these beds. In fact, there are considerable patches there of Kuttung glacial landscape rediscovered by modern denudation. In Tasmania the glacial series has a thickness of about 800 feet. Splendid sections can be seen between tides on the beach E. of Wynyard. Several striated pavements in the tillite show that the ice moved from SSW. to NNE. An interesting fact which has lately come to light is that there are at least three—perhaps four—distinct tillite horizons, separated from one another by strata perhaps representing interglacial epochs. Each tillite horizon can be correlated certainly with those of Victoria, and almost certainly with those of South Africa.

In Western Australia glacial tillite occurs on a large scale at the base of the Irwin River coal-field, and the glacial conglomerate has been traced from near the Carnarvon bore (at the mouth of the Gascoyne River) to the Wooramel River, and almost up to the latitude of North-west Cape. Thus in Western Australia these glacial beds actually touch the region of the tropics. As evidenced by the nature of the contained boulders, when compared with their nearest parent rocks, it is clear that the ice-sheets which produced this glaciation moved, on the whole, from the inland plateau westwards or northwards—probably in a north-westerly direction, inasmuch as the glacial boulders become progressively larger the farther south they are traced. These glacial beds are known as the 'Lyons conglomerate.' So far no striated floor has been discovered beneath them.

To sum up: (*a*) In regard to Palaeogeography the ice which glaciated Tasmania, Victoria and South Australia came from the south, from a land which was probably a local extension of the Australian continent into the Southern Ocean. The glaciation of Cambrian time in Australia came from the same quarter. In Western Australia the glaciation is thought to have come from the south-east, from local highlands near the southern end of the State. In eastern Australia the region affected by the glaciation was a landscape apparently of low relief, but we know nothing of the height of the gathering-ground of the ice-sheets on the now sunken part of the continent, where the eastern end of Jeffrey's Deep shows a depth of 3000 fathoms. Possibly the large bank recently discovered, which lies about 200 miles south of Tasmania and rises from great ocean depths to within 500 to 600 fathoms of the surface, formed part of a high south-eastern margin to Australia, extending in Carboniferous time from this bank to Kangaroo Island. In New South Wales there seem to have been local alpine glaciers. In the south-western region of Western Australia there seems to have been a local ice-sheet. (*b*) There were at least three interglacial phases in Australia, probably to be correlated with those of Africa. (*c*) The fauna, especially because of the disappearance of lower Carboniferous reef-forming corals, suggests glacial refrigeration of the seas, while the flora of the coal-seams is not inconsistent with that of a climate like that of Macquarie Island. (*d*) In Carboniferous time the snow-line touched sea-level probably near 40° S. lat., and glaciers came down to sea-level at about 34° S. lat. (*e*) This may indicate a fall of temperature, as compared with the present, of about 10° C.

The upper Carboniferous is represented by a marine series, forming that lower portion of the lower marine series of the so-called Permo-Carboniferous system which includes the *Eurydesma cordata* horizon, and extends downwards to the Brandon conglomerate. Considerable economic interest may attach to the Carboniferous rocks of the Kimberley region on account of the recent discovery of traces of rock oil in them at Price's Creek ESE. of Geikie Canyon on the Fitzroy River, and of asphalt glance in the vesicular basalts at the junction of the Ord and Negri rivers, near the north-western boundary of the Northern Territory.

Permo-Carboniferous (*Permian*) *System.*—Of all the sedimentary formations developed in the Commonwealth this system is perhaps the most interesting. The interest depends, in the first place, on the remarkable development of the *Glossopteris* and *Gangamopteris* flora, which replaced everywhere within the Commonwealth the *Lepidodendron* flora of the preceding system; and, in the second place, on its marine fauna,

which belongs to two sharply differentiated types —the western, allied to the Permo-Carboniferous fauna of India, and the eastern, a distinct fauna in many respects unlike any developed in other parts of the world. Furthermore, probably nowhere else in the world are Permo-Carboniferous strata of such thickness, or so rich in diversified forms of animal life.

In regard to the upward passage from the Carboniferous strata into the Permo-Carboniferous, while there is little evidence of unconformity in some places, in others (e.g. near Lochinvar in the Hunter valley of New South Wales) the unconformity is fairly strongly marked. At the same time it is not nearly as strong as that developed in the British Isles between the Permian dolomitic breccias and the Carboniferous rocks.

While the Carboniferous strata in the Commonwealth are mostly disposed in fairly close folds, the Permo-Carboniferous strata are either perfectly horizontal or disposed in broad open troughs and arches. Only at Drake, Undercliff and Ashford in New South Wales, and at Gympie in Queensland, are the strata of this system highly disturbed near granitic intrusions.

The term 'Permo-Carboniferous,' in view of the present state of our knowledge, is somewhat of a misnomer. It was applied, in the first case, by R. L. Jack and R. Etheridge, junior, to certain strata in Queensland, which undoubtedly did include forms of life (chiefly marine) that were characteristic partly of the Carboniferous, partly of the Permian age. It is now known that in Queensland these rocks can be sharply divided into two groups—an older, in which *Lepidodendron* and *Phillipsia* are present, and a younger, which lacks them but contains a marine fauna distinctly comparable with that of the Hunter River region of New South Wales. In spite of the fact that some of the brachiopods of this Permo-Carboniferous system show affinities with those of the Carboniferous, it appears to the writer that there is no longer need for the retention of the term Permo-Carboniferous, but that the strata of this system should be considered to be mostly Permian. In parts of Western Australia where Permo-Carboniferous rocks are developed (as at the Gascoyne, Wooramel, and Minilya rivers) a well-marked glacial horizon, the 'Lyons conglomerate,' underlies the bulk of the Permo-Carboniferous strata. There is now little doubt that this glacial horizon is identical with that of Bacchus Marsh in Victoria, Hallett's Cove in South Australia, Wynyard in Tasmania, and Lochinvar and Kempsey in New South Wales. All the strata above this glacial horizon might fairly be termed Permo-Carboniferous at any rate, if not Permian, the main glacial horizon being referred to the Carboniferous. In the Kimberley district of Western Australia the glacial horizon has not been identified definitely—and perhaps does not exist there; but the fossils are essentially similar to those above the horizon of the Lyons conglomerate, and may therefore provisionally be classed as Permo-Carboniferous and even Permian. While, therefore, considering that there is much to justify the use of the term 'Permian,' the writer proposes to retain for the purposes of this article the old term 'Permo-Carboniferous,' chiefly because it has been so widely used and generally accepted.

Rocks of this system are very widely spread throughout the Commonwealth. In Tasmania about one-half of the island (which is rather bigger than Ceylon, but smaller than Ireland) is covered with rocks of this age. Here the tillite beds of the Wynyard series, which are of Kuttung (middle to upper Carboniferous) age, are succeeded by marine strata belonging to the lower marine series, over 600 feet thick at this locality. This series is followed by one of the most important coal-bearing horizons in Australia, the Greta series, represented in Tasmania by only a few seams of coal, from 20 inches up to 3½ feet in thickness; in places this coal passes into kerosene shale, formed largely of the problematical plant considered to be an alga, *Reinschia australis*. Above the Greta series in Tasmania is a considerable development of rocks of the upper marine series; the great series of freshwater coal-measures developed in New South Wales and Queensland above the upper marine series are wanting, and rocks of Trias-Jura or Jurassic age rest conformably on the topmast marine beds of the Permo-Carboniferous system.

In Victoria the whole series of Kuttung glacial beds passes upwards into sandstones containing *Gangamopteris*, and is over 2000 feet in thickness; no marine strata or coal-seams have been hitherto discovered. Still farther west, in the south-western corner of Western Australia, a small basin preserved in a deep trough-fault is known as the Collie coal-field; it contains *Glossopteris* and *Gangamopteris*, associated with numerous seams of coal up to over ten feet in thickness. The strata are water-bearing between the seams, but fortunately the roofs of the seams are impervious. The percentage of ash is only from about six to eight per cent, and there is from 30 to 40 feet, in the aggregate, of workable coal. The coal itself, contrary to our usual experience in strata of this age, is distinctly hydrous. Northwards from Perth the Irwin River region has preserved a small patch of glacial beds immediately underlying richly fossiliferous marine strata that include limestones, conformably overlying brown clay shales. Two seams of coal conformably overlie the marine strata; the main seam is five feet thick and, though not so proved by fossils, presumably of Permo-Carboniferous age. In the Kimberley district of Western Australia there is a considerable development of marine Permo-Carboniferous calcareous sandstones and limestones; it has been proved that from the Gascoyne River to the Kimberley district these Carboniferous strata contain invaluable supplies of artesian water, though (strange to say) they are quite wanting, as far as they have yet been tested, in productive coal-seams. Strata of this age extend farther east round the Australian coast to the Victoria River, where the marine strata are associated with freshwater shales containing *Glossopteris*. This *Glossopteris* underlies strata that contain *Orthotetes* and *Aulosteges*. The formation has been traced into Arnhem Land (NE. of Darwin), and to the islands off the north-eastern extremity of Arnhem Land. Groote Island is thought to belong to this system. A remarkable feature is that, from the Gulf of Carpentaria round to the Irwin River region, the whole assemblage of marine Permo-Carboniferous fossils is distinctly of Indian type. SSE. of Cape York is a deep indent in the coast-line marking a prolongation of the trough-valley in which lies the Permo-Carboniferous coal-field of the Little River. As the result of heavy downthrows the strata have been forced into rather sharp zigzag folds, a rare structure in rocks of this age in

Australia. Coal of good quality is worked at Mount Mulligan, W. of Cairns. Near Townsville is a small development of Permo-Carboniferous strata, which there underlie the coastal plain, and extend out to sea beneath the reefs of the Great Barrier. Next we reach the classical coal-field of the Bowen River. There evidence of glacial action, in the form probably of floating ice, is to be found in the shape of numerous small boulders of granite and other rocks foreign to the district, embedded in the clay shales of the Permo-Carboniferous system; but nothing approaching a true tillite has ever been observed in this area. Next, on the south, come the extensive and thick coal-seams of the Dawson River basin. The thickest seam known in Australia in rocks of this system occurs at Blair Athol, where the main seam is at least up to 93 feet thick. Steam coal of good quality occurs in a seam 11 feet thick on the Dawson River, about 30 miles south of Duaringa, but unfortunately the coal-field in that area is much broken up by faults. The Permo-Carboniferous system in this important coal-field can be divided into the following groups, which are arranged in ascending order:—(*a*) Marine beds such as those of Gympie, with boulders presumably transported by ice. (*b*) Lower marine strata, followed by a volcanic series. (*c*) Freshwater strata, with the 11-ft. seam of steam-coal already described. (*d*) The marine shell beds of Oakey Creek and St. Mary's, capped by the *Glossopteris* beds of Oakey Creek and St. Mary's. All these strata are grouped together as Lower Bowen. There follows a slight unconformity, and above it are developed the marine shell beds of Claremont and Capella. Above these again, and slightly unconformable to them, are the Tolmies and Blair Athol coal-measures, the latter capped by the old auriferous conglomerates of Claremont. The whole of this last series is grouped together as Upper Bowen. No estimate has, as yet, been formed of the available quantity of Permo-Carboniferous coal in Queensland, but it must be very vast—perhaps approximating to the 100,000,000,000 tons roughly estimated to be present in the form of exploitable coal in New South Wales.

South-east of the Dawson field the Permo-Carboniferous strata are represented by the basal marine beds of the Gympie goldfield. Wherever the quartz reefs which traverse these strata come in contact with the occasionally intercalated beds of black carbonaceous shale, they are payably gold-bearing. The Dawson coal-field, traced in a southerly direction, reaches the borders of New South Wales near Bonshaw and Ashford; at the latter place a fine seam of steam coal, 27 feet thick, is to be seen in the left bank of the Severn River. As *Gangamopteris* is the only fossil known to occur in association with this seam, it may provisionally be considered of Greta age. This field occupies a narrow fault-trough. About 100 miles east of this spot, at Undercliff, there are beds of graphite associated with intrusive acid granites, which are considered to represent intensely metamorphosed coal-seams of Permo-Carboniferous age. These graphitic strata are to be connected with marine beds of undoubted Permo-Carboniferous origin, as at the goldfield of Drake, where contemporaneous acid and basic lavas are inter-stratified with the lower beds. The Permo-Carboniferous strata at Drake have been recently traced in Queensland near Silverwood, southerly from Warwick; upper and lower marine beds, and either Newcastle or Greta coal-measures, are developed there, and are much crushed and folded. The newest acid granite intrudes part of this series if not all of it.

South from Ashford the region of Gunnedah is reached, from which the principal coal-field of New South Wales extends without a break for fully 300 miles, as far south as the head of the Clyde River near Ulladulla. The type-district in this field is that of Maitland in the Hunter valley, where the Permo-Carboniferous series is ushered in by marine passage beds, tuffaceous shales and a flow of natrolite basalt, followed by *Eurydesma cordata* beds, above which is a thick series of beds forming the upper portion of the lower marine series. The Greta coal-measures, from 100 to 300 feet thick, which conformably overlie the lower marine series, are not relatively rich in fossil plants. It is significant that in them *Gangamopteris* predominates over *Glossopteris*, whereas in the higher coal-measures of this system the reverse is the case. *Gangamopteris* has been found as low down as 2000 feet below the Greta coal-measures, in the middle of the lower marine series. The Greta coal-measures usually contain about 20 feet of workable coal—and, exceptionally, as much as 40 feet. The upper marine strata, which follow the Greta, attain the maximum thickness yet proved in the Hunter River region, 5000 to 6400 feet. About half-way up in the series erratics, certainly of glacial origin, are very numerous in places, occurring usually in groups; many are from one to two tons in weight, and appear to have been derived from the region of Mount Lambie, near Rydal or Bathurst, about 200 miles SW. It is significant, probably, of glacial conditions that we find an almost total absence of reef-forming corals in the Permo-Carboniferous strata; such corals as do occur are small dendroid types, like *Zaphrentis* and *Trachypora*. Near the top of the upper marine series, as well as on certain horizons lower down, are remarkably large pseudomorphs known as glendonite. These crystals attain a length of from two inches to one foot. They are best seen on the beach between tide-marks at Huskisson on Jervis Bay, about 100 miles S. of Sydney, where the shore presents the appearance of a medieval battlefield, strewn with spear-heads and caltrops. They are pseudomorphs after the double sulphate of sodium and calcium, glauberite. As deposits of sodium sulphate are very common and characteristic in Antarctica, these glendonites may have some climatological significance. They have also been found in Tasmania, close to the horizon of the oil shale known as Tasmanite, in part of the Mersey coal-basin. Above the upper marine follow the strata of the middle coal-measures (East Maitland or Tomago). These are from 500 to 1800 feet thick, and contain in the aggregate about 40 feet of coal, which, being more friable than that of the Greta, is not so suitable for export though useful for household, gas, and blacksmithing purposes. A total thickness of about 18 feet of coal is worked. In parts of the Hunter River coal-field there follows a considerable thickness (in places about 2000 feet) of freshwater strata, with abundant plant remains, but devoid of any coal-seams of workable thickness. These beds belong to the Dempsey series. Above the Dempsey comes the Newcastle series, 1200 to 1400 feet in thickness, with about 120 feet of coal. The thickness of the seams varies from one foot up to about 27 feet, and the aggregate thickness of workable coal from 35 to 40 feet. At Awaba on the

shores of Lake Macquarie, as well as at the lake's southern entrance (Reid's Mistake), are fossil forests of coniferous trees. At the latter locality it can be seen that the trees sprang directly from the upper portion of a coal-seam, being actually in position of growth. The lower parts of the stem are of carbon; upwards they pass into chalcedony, where they have been buried under showers of very fine volcanic tuff. The tuff has evidently broken down branches of the trees, and resin has exuded from the fractures, and is preserved now in the form of black drops in the tuff, the latter being converted into chert. Some of these coniferous trees can be seen to be over 100 feet in length.

On the whole the evidence favours the view that most of the coal-seams of the Permo-Carboniferous system were formed at the spot where seams are now found. In the underclay only thin rootlets have been observed; in the clay bands higher up in the seam, numerous specimens of *Vertebraria* can be frequently seen in position of growth; and only in the actual roofs of the seams have forest trees like the conifer *Dadoxylon* been proved to exist. In places (but rarely) remains of fossil fish and of labyrinthodonts have been discovered in the coal-measures, from those of Greta age up to those of Newcastle age. A small labyrinthodont has been recorded from the Mersey coal-measures (Greta horizon) near Railton; another (*Bothriceps*) was found in the kerosene shale at Airlie, in the western coal-field of New South Wales. *Palaeoniscus* has been obtained from the marine (probably lower marine) Permo-Carboniferous rocks of Tasmania, and *Urosthenes* from the Newcastle coal-measures of New South Wales. The upper coal-measures of the Newcastle series have yielded numbers of the phyllopod *Leaia mitchelli* and some very interesting fossil insects of the holometabolous type which have not elsewhere been found in Palaeozoic rocks. The total amount of exploitable coal in these measures in New South Wales, in seams not less than three feet thick and not more than 4000 feet in depth, is estimated to be roughly about 100,000,000,000 tons.

Trias System.—Rocks of this age are at present known chiefly in the Sydney and Blue Mountain areas of New South Wales. In Tasmania, however, the Knocklofty series—variegated sandstones, 1000 feet thick, which in the neighbourhood of Hobart overlie the Permo-Carboniferous strata—have been doubtfully referred to some part of Triassic time. They contain remains of *Acrolepis hamiltoni* and *A. tasmanicus*, and bones of a labyrinthodont. The occurrence in the sandstones of *Vertebraria indica* suggests affinities with the Permo-Carboniferous system. The Ida Bay series, containing *Zeugophyllites* and *Pecopteris lunensis*, is perhaps Triassic. In regard to the Fingal series in the Tasmanian coal-measures, as some doubt exists as to whether they belong to the top of the Trias or to the base of the Jurassic, they will be described later. The Triassic strata of New South Wales extend along the coast from the Cambewarra Range in the south to Lake Macquarie near Newcastle in the north; thence they stretch NW. to beyond Gunnedah, and W. to a little beyond Lithgow. The rocks in this area have been divided (chiefly lithologically) into three stages which, in descending order, are as follows:—upper Triassic, Wianamatta shales—thickness about 800 feet; lower Triassic, Hawkesbury sandstone, thickness about 300 to 1000 feet; Narrabeen beds, thickness about 200 to 2000 feet.

The strata of the Narrabeen stage are largely tuffaceous, but the true tuffs do not constitute more than about one-tenth part of the whole thickness. In their lower portion they are mostly grey to greenish-grey sandstones, with greenish conglomerates and grey-green and reddish to chocolate-coloured shales. Bands of blackish-grey shale are crowded with remains of *Estheria Coghlani* and other species of this genus. Five hundred feet above the Bulli coal-seam (the top of the Permo-Carboniferous system) tuffaceous red shales and green tuffs contain innumerable small scales of metallic copper, together with microscopic veins of the same metal; these strata are known as the cupriferous tuffs. Over 1000 feet above these tuffs is a second series of green tuffs and chocolate-red shales. In the latter at Long Reef, 12 miles NE. of Sydney, beautiful examples occur of plants resembling *Phyllotheca*, with their stems of brittle bituminous coal, held together in a delicate filigree-like network of metallic copper. Where the strata have been much weathered, the metallic copper passes into green and blue carbonates. The copper has obviously been derived from the decomposition of the basic tuffs. The tuffs are traversed in places by small veins of barytes.

The Hawkesbury sandstone, which is typically developed at Sydney and in the Blue Mountains, is chiefly formed of white to yellowish-grey sandstones, very regularly and evenly bedded, diagonal bedding being very conspicuous. South of the Hawkesbury River, in the area where this diagonal bedding dips NE., primary graphite is scattered in scales or small pellets through the sandstone. North of the Hawkesbury the diagonal bedding dips in almost the opposite direction—that is from off the New England tableland—and this part of the formation does not contain graphite. Small garnets are not infrequent in the southern type of Hawkesbury sandstone. Certain beds in this stage form a valuable building stone, largely worked in Sydney and suburbs, which as the result of chemical changes in the iron carbonates weathers to a pleasing tint of warm sepia. A few bands of dark clay shale, interstratified with the sandstone, often show evidence of having been disrupted contemporaneously, the fragments being upended so that their lamination planes are now vertical. Neither the sandstones above nor those below show any signs of disturbance. This phenomenon, together with that of contemporaneously contorted current-bedding, has been ascribed to the action of ice; but other explanations, such as that of undercutting of the clay shales by stream action, are possible. As the result of the removal by capillarity of soluble mineral cement from the inner portion of the sandstone, and its transference to the exterior, these sandstones weather into picturesque shelter caves. The Wianamatta stage is formed of black carbonaceous shales, with at least one seam of coal, which with its clay bands is about four feet thick. The upper half of this stage is sandy and calcareous, ending in a calcareous tuffaceous rock, 100 feet thick, containing a very interesting foraminiferal and ostracodan fauna.

As regards fossil plants, *Thinnfeldia odontopteroides* is specially characteristic and abundant throughout the whole series. *Macrotaeniopteris* and *Phyllotheca* are also typical. *Sphenopteris* is also common, and in places is associated with *Alethopteris* (*Cladophlebis*), but this

last genus is much more characteristic, in Australia, of the Jurassic rocks than of the Triassic. Near the base of the Narrabeen stage beautifully preserved specimens of *Schizoneura* are fairly common; and the genus not only extends downwards into the strata which form the roof over the Bulli coal-seam, but at the Sydney harbour collieries shaft at Balmain has been found associated in a bed of clay shale with *Glossopteris*. *Schizoncura* has never been found in either the Hawkesbury or in the Wianamatta stages, but occurs in Victoria in strata conformably overlying the *Gangamopteris* sandstones and glacial beds at Bacchus Marsh.

Stems of trees are numerous in the tuff beds near the top of the stage, as well as forms allied to *Baiera*. Fossil fruit are plentiful in these beds at Long Reef and Narrabeen, N. of Sydney. Reference has already been made to the abundance of *Phyllotheca*, some stems of which are partly encrusted with metallic copper. Just at the top of the Narrabeen stage, or possibly a few feet up into the Hawkesbury sandstone stage, is a bed of shale at Gosford which has proved remarkably rich in remains of fossil fish and small labyrinthodonts; the principal forms found are *Palaeoniscus, Myriolepis, Cleithrolepis, Apateolepis, Dictyopyge, Belonorhynchus, Semionotus, Pristisomus, Pholidophorus*, etc.

In the Hawkesbury sandstone stage a problematical fossil plant, *Ottelia praeterita*, occurs sparingly. In the occasional intercalated shale beds *Oleandridium* has been recorded, while *Thinnfeldia odontopteroides* is very abundant. The leaves are well preserved, and sufficiently coherent and flexible to be lifted off the surface of the shale; when subsequently examined under the microscope, they are seen to have preserved much original structure. At Biloela (Cockatoo Island) near Sydney a thoracic plate of *Mastodonsaurus* was found, and at the same spot (strange to say) a specimen of *Trematonotus*. This Silurian genus on a Triassic horizon suggests that the fossil may be an erratic in this formation. It is preserved in ironstone, which may have replaced a small fragment of limestone. In shales of the Wianamatta series most of the fossils are either at the base or near the top of the stage. Just as the Hawkesbury sandstone usually rests on an eroded surface of Narrabeen beds, as at the junction line of the Wianamatta shales with the Hawkesbury sandstone, there is in many cases evidence of contemporaneous erosion. A good deal of concretionary clay ironstone has formed in the basal beds of the Wianamatta shales, and these are mostly fossiliferous. In addition to *Thinnfeldia* and *Phyllotheca, Cycadopteris scotopendrina* has been recorded from these beds. True cycads appear on the whole to be wanting throughout the Australian Triassic rocks.

In the ironstone concretions referred to above shells of mollusca are often very abundant, belonging to the genera *Unio* and *Unionella*. The dwarf character of these shells suggests that the strata containing them were deposited in brackish water. In the brick-pits of Newtown and Enmore (Sydney) numerous well-preserved specimens of fossil fish have been obtained, ranging from a few inches up to six feet in length.

Labyrinthodont remains have been found on this horizon both at Enmore and at the 'Gib' tunnel near Bowral. The specimen discovered at the former locality measures 12 feet in length. Its immense jaws are furnished with rows of smaller conical teeth and relatively large tusk-like teeth. A perfect cast of the brain is to be seen in this unique specimen. The original specimen, preserved in clay ironstone, has never yet been described. It is now at Brisbane, in the possession of the government geologist of Queensland, who has presented it for descriptive purposes to the Australian National Research Council.

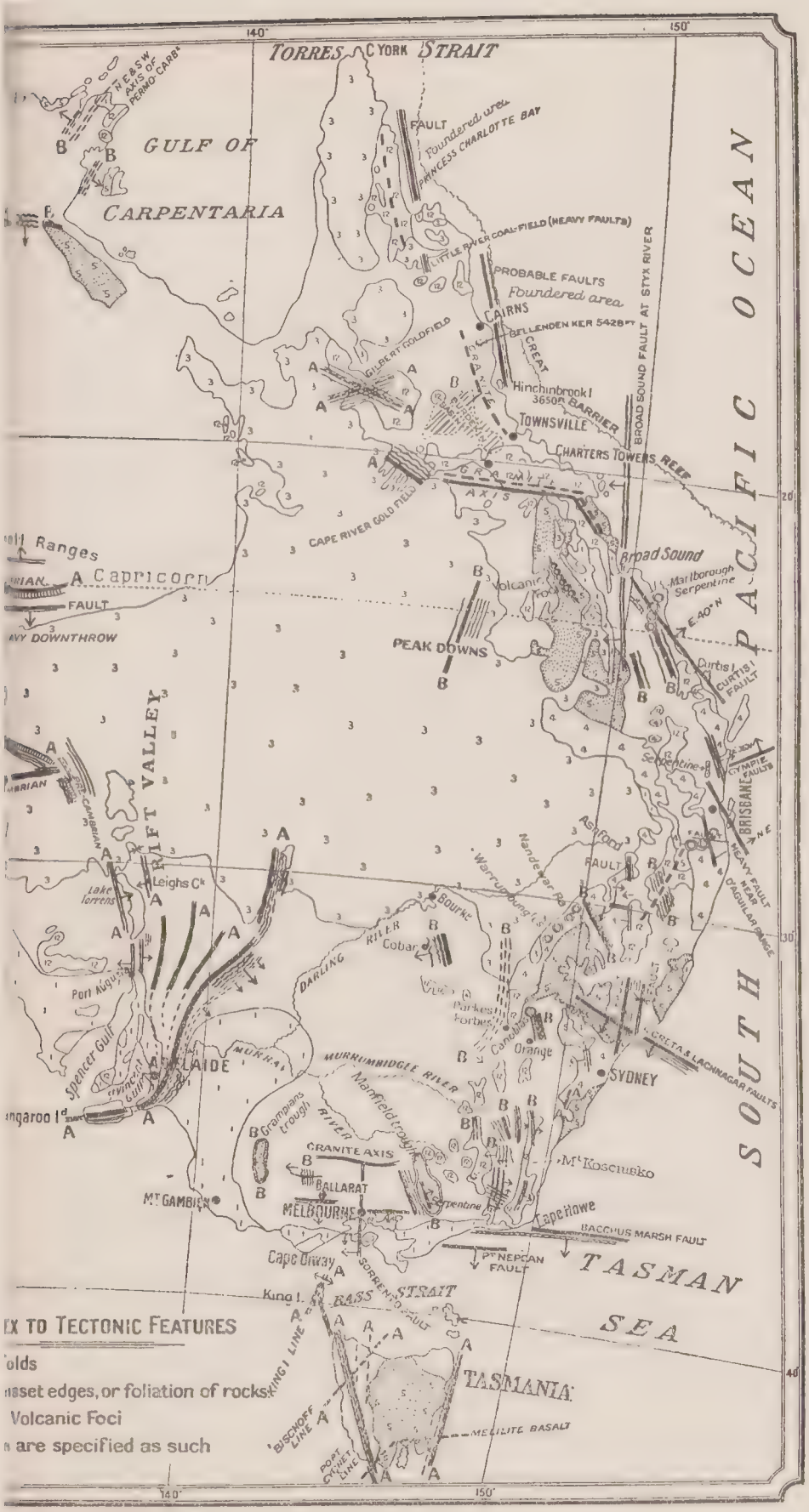
The Wianamatta stage closes with the bed of greenish tuffaceous and calcareous sandstone, passing into sandy limestone, largely formed of foraminiferal and ostracodan shells. Comment has been made on the fact that in this horizon of the Wianamatta stage we have a remarkable example of the survival of a Silurian type of ostracod in the genera *Beyrichia* and *Endothyra*; also on this horizon is an interesting survivor from the Carboniferous fauna. On the other hand the genus *Haplophragmium*, which also occurs on this horizon, is not known elsewhere to descend so low stratigraphically. The Wianamatta beds have also yielded an insect fauna from a quarry at St. Peter's. The Coleoptera are the most abundant, but representatives of the Blattoidea and Protorthoptera were also found. This fauna has affinities with that of the Ipswich beds, which are also of Triassic age.

The geographical conditions under which the strata of the Hawkesbury series were accumulated appear to be those of a large shallow lake close to the sea, with which possibly there was intermittent communication. The *Gangamopteris-Glossopteris* flora of the Permo-Carboniferous ice age had (with the exception of *Phyllotheca, Sphenopteris*, and perhaps *Alethopteris*) completely disappeared before the earliest strata were deposited in this great lake-basin. Eruptions, perhaps of the Kiama-Cambewarra region, and at all events of that zone, were prolonged into Triassic time, as is proved by the frequent beds of basic tuff in the Narrabeen stage. The evidence of ripple-marks and suncracks on many horizons all through the series points obviously to shallow-water conditions. The foraminiferal ostracodan sandy limestone and calcareous sandstone at the top of the whole series prove that, after a subsidence near the centre of the basin of about 3500 feet, marine (or at least estuarine) conditions supervened. The flora of these Triassic rocks differs from the Jurassic by the presence in the former of *Phyllotheca* in vast numbers, and of *Oleandridium*, while *Taeniopteris daintreei* and the varieties of cycads so common in the Australian Jurassic rocks are wanting in the Trias. Triassic types of *Estheria* do not descend into the Jurassic, neither do the labyrinthodonts.

Endothyra, Beyrichia, Trematonotus (?), and *Palaeoniscus* all represent Palaeozoic forms of life surviving into Mesozoic time. The Clarence series of New South Wales is now considered to be the equivalent probably of the Hawkesbury series, the upper, middle and lower Clarence stages corresponding respectively to the Wianamatta shales, Hawkesbury sandstone and Narrabeen stage. Productive coal-seams occur in the lower Clarence beds up to over 30 feet thick, but most of them contain many clay bands.

It is doubtful whether the Fingal series and other representatives of the upper coal-measures of Tasmania are to be classed as upper Trias (perhaps Rhaetic) or lower Jurassic. As *Taeniopteris daintreei* (*T. spatulata*), regarded in Australia as a critical form for differentiating the Jurassic from the Trias, has never yet been found in Tasmania, and the genus *Phyllotheca* is of common occurrence in these Tasmanian

TECTONIC FEATURES OF AUSTRALIA AND TASMANIA.



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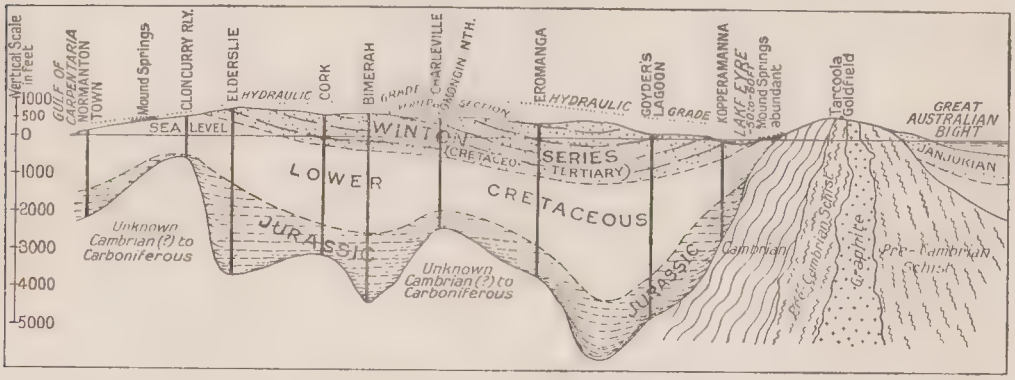
coal-measures, it is proposed to class them provisionally as upper Trias, or passage beds into the Jurassic proper. *Thinnfeldia odontopteroides, Alethopteris australis* (*Cladophlebis denticulata*), *Taeniopteris tasmanica, T. morrisiana, Phyllotheca,* and *Zeugophyllites elongatus* (*Phaenicopsis,* or *Podozamites*) are most characteristic. Other forms present are *Ptilophyllum oligoneurum, Sphenopteris lobifolia, Pterophyllum, Baiera tenuifolia, Ginkgophyllum australe,* etc. It may be stated generally that the Fingal coal-measures are not as rich in fossil cycadaceous forms as are the true Jurassic rocks of the mainland. These measures, about 1200 feet thick, are formed chiefly of yellow, brown, greenish, and bluish-grey sandstones, with coal-seams from four feet up to 20 feet in thickness. The coal is of fair quality, containing from one per cent up to four per cent of moisture, and from nine per cent up to 15 per cent of ash.

In Queensland the Triassic is represented by the Ipswich series and the Bundamba series that overlies it. The Ipswich beds are now thought to be the equivalent of the Narrabeen shales of New South Wales. They consist of grey-coloured to red shales and sandstones with some interbedded conglomerates. Some 14 or 15 coal-seams are interbedded with the series; the coals are chiefly steam coals, and are suitable for the manufacture of coke. The Ipswich beds have a limited extent, and in the type-district near Ipswich attain a thickness of about 2500 feet. An abundant fossil flora has been recorded, of which the chief types are *Neocalamites hoerensis. Cladophlebis australis, Thinnfeldia* (3 species), *Taeniopteris tenison-woodsi, Stenopteris elongata, Ginkgo, Baiera* and *Pterophyllum.* A phyllopod (*Estheria mangaliensis*) is also recorded. At Denmark Hill a rich insect fauna was collected by Dunstan, and has been described by Tillyard; the insects include representatives of many distinct orders, and a large proportion of the species are new. This insect fauna contains types such as *Austromylacrites, Mesorthopteron,* and *Mesomantidion,* and a true hemipteroid, probably to be referred to the Protohemiptera; they are characteristic of the late Palaeozoic of the northern hemisphere. Other types include a true dragonfly (probably an anisopterid) and a panorpid (Mecoptera). This fauna is related to the Jurassic of Europe, but appears to have developed earlier in Australia.

The Bundamba series comprises a thick series of massive sandstones, practically unfossiliferous. The beds attain a thickness of from 3000 to 5000 feet, overlying the Ipswich series and underlying the Walloon series. They are probably of middle Triassic age, and the equivalents of the Hawkesbury sandstone.

Jurassic System.—Rocks referable to this period belong to what was probably the greatest lake epoch through which the Australasian continent has passed. The principal lake extended from some point south of Dubbo at least as far north as the far extremity of the Bunya Bunya ranges of Queensland, north-west of Dalby—and probably still farther, up to the Cloncurry area; westwards it stretched more or less continuously to Lake Eyre, and still farther westwards to Lake Phillipson. The lake would thus have had a total length of 1200 miles from east to west, with a width from north to south of 700 to 800 miles. The strata deposited in this lake (or chain of lakes) are the main source of supply of artesian water in the great artesian basin. They vary in thickness from 300-400 up to over 4000 feet. Eastwards the basin extends through a narrow neck near Brisbane to the coast at the mouth of the Brisbane River, and also by a wider passage along the basin of the Clarence River between Ballina and Woolgoolga. That there is no outlet of consequence, if any at all, for the artesian basin in this direction is proved by the fact that a bore has been put down to a depth of 4000 feet at Grafton, and only a feeble trickle of artesian water has been tapped. The same remark applies to the bore on the race-course at Brisbane. The section shows somewhat arbitrarily the line of junction between Jurassic and Cretaceous rocks, and is to be regarded as provisional only; as most of the boring is done by percussion, the fossils in the strata passed through are usually in such a fragmental state that identification is often very difficult.

The section given below shows the hydraulic grade descending from Charleville as a centre N. to the Gulf of Carpentaria, and S.W. to Lake Eyre. At its south-western end the basin is apparently blocked by impervious pre-Cambrian or older Palaeozoic rocks, so that apparently it has no outlet in that direction. Towards the north a sill of older rock rises so high above the general floor of the basin that it would seem to go far towards checking any important underflow and outflow to the sea in this direction also. The explanation of the fall of the



Section across Great Artesian Basin from the Gulf of Carpentaria to the Great Australian Bight.

hydraulic grade seawards from Charleville, in Queensland, would seem to be either (*a*) that there are narrow subterranean outlets, not yet tapped in the bores, both in the direction of the Bight and in that of the Gulf of Carpentaria; or (*b*) that before the bores were sunk the chief outlet for artesian water was through those natural artesian wells, the mound springs. These are very numerous on the lower Flinders River in the north, and near Lake Eyre towards the south-western end of the basin. That springs connected with faults may supply part of the artesian water is obvious; but it is probable that by far the larger proportion has a meteoric origin, being derived from rain falling directly on the outcrop of the porous beds, or leaking into them from the channels of rivers. This supposition receives some confirmation from the Cainozoic analogue of the artesian basin at Perth where the interdependence between rainfall and the outflow of artesian water has been distinctly proved; but conditions in the Perth artesian basin are not in every respect analogous to those in the central Jurassic basin. For example, in the latter the factor of gas pressure is very important in helping to force the artesian supply to the surface. Over 90 per cent of the gas concerned in producing this pressure is nitrogen; gases like CH_4, CO_2, H_2S, etc., are present in far smaller proportions. This nitrogen is almost certainly not of plutonic origin, but is probably derived from the atmospheric nitrogen dissolved in meteoric waters supplying the artesian basin. The temperature of the water is in some cases as high as 204° Fahr., even when the water arrives at the surface. But, so far, the waters from the chief bores which evolve nitrogen have much lower temperatures than the above (see ARTESIAN WATER).

Strata of Jurassic age are also found on the eastern periphery of Australia and in Tasmania as well as in the coastal regions of Western Australia. In Queensland they are represented by the Walloon series. These beds cover a large area, and form the principal intake beds bordering the eastern margin of the great artesian basin. In places they are estimated to be about 4000 feet in thickness. They are the equivalents of the Talbragar series in New South Wales. The Walloon series have yielded an abundant fossil flora, the most characteristic types being *Equisetites rotiferum, Cladophlebis australis, Thinnfeldia* (3 species), *Sagenopteris rhoifolia, Taeniopteris spatulata* (*T. daintreei*), *Ptilophyllum pecten, Otozamites queenslandi, Araucarites polycarpa,* and *Brachyphyllum crassum.*

The coals of the Walloon series are rich in volatile hydrocarbons, and are more suitable for gas-making than for steam-raising purposes. The basal beds are calcareous, and at Roma yield natural gas. Over 80 per cent of the gas is methane, the remainder being partly petrol gas, partly inert gases. Mineral oil in small quantities has been obtained from six artesian bores between the Roma and Blackall districts. A small isolated patch of Jurassic rock also occurs at Talbragar, between Mudgee and Dubbo in New South Wales. These strata, which rest on an eroded surface of Hawkesbury sandstone, contain the following fossils:—*Taeniopteris daintreei, Alethopteris australis, Thinnfeldia falcata, Podozamites lanceolatus,* and *Baiera bidens.* Insects are represented by an ancestor of the true locust, the fossil form being described as *Cicada lowei.* Among the very numerous fish are *Leptolepis gregarius, Archaeomaene robustus, Coccolepis,* etc.

In Victoria there are three considerable areas of Jurassic rocks—in south Gippsland, the Cape Otway district, and the neighbourhood of Merino in the west. The strata consists of felspathic sandstones with abundant fresh fragmental felspar (perhaps of tuffaceous origin), besides shales, mudstones, and seams of coal. The seams are worked commercially in the Cape Paterson district and at the State-owned colliery at Wonthaggi. The coal is of fairly good quality, and the thickness of the seams varies from two to nine feet. The following are among the most characteristic fossils:—*Coniopteris hymenophylloides, Cladophlebis denticulata, Sphenopteris ampla, Thinnfeldia odontopteroides. T. maccoyi, Taeniopteris spatulata* and vars. *daintreei* and *carruthersi, Podozamites barklyi, Ginkgo robusta, Baiera subgracilis, Palissya australis, Brachyphyllum gippslandicum, Unio stirlingi.* At Cape Paterson a tooth of *Ceratodus* (*C. avus*) has been found, and scales of *Ceratodus* have been described from the parish of Kirrak in south Gippsland. Another interesting discovery has been that of a claw of a dinosaur, also in the Cape Paterson beds.

In South Australia, S. of Lake Eyre, there is a small Jurassic (possibly Triassic) coal-basin, preserved in a deep trough-fault. This is the Leigh's Creek coal-basin, whose strata of sandstone and carbonaceous shales are over 2000 feet in thickness, and comprise several seams of coal, one 47 feet in thickness. The coal is a hydrous brown coal. The chief fossils are *Thinnfeldia odontopteroides, T. media, Macrotaeniopteris wianamattae, Podozamites lanceolatus,* and an immense number of the fossil pelecypod *Unio eyrensis,* which occurred in almost every foot of the bore-core, from the surface to a depth of over 1500 feet.

The only marine equivalents of strata of Jurassic age within the Commonwealth are found on the west of Western Australia; they are chiefly developed in the Northampton district, extending thence by way of the Greenough River to Gingin, about 40 miles N. of Perth. The strata consist of white sandstones, ferruginous sandstones, light-coloured claystones, grits, limestones, and shales, with lignites. Their maximum thickness is quite 3000 feet. Occasional green patches in the ferruginous sandstone contain the phosphatic mineral dufrenite. Artesian water has been struck in this formation at Dongara and at Yardarino; but, after flowing for a few years, the flow has ceased—at the former locality through the bore becoming choked, and at the latter through failure of the supply. The following are the most typical fossils in this area:—*Otozamites feistmantcli, Zigno, Pagiophyllum* (?), *Pentacrinus australis, Trigonia moorei, Teredo* (found in its own bores in fossil wood), several varieties of Jurassic ammonites, and remains of large enaliosaurians.

A very important unit in the geology of Tasmania are the huge sills of diabase (granophyric dolerite and enstatite-augite-dolerite) often over 500 feet thick, which have been intruded into these coal-measures. They are almost certainly pre-Cainozoic. If they are of the same age as the great dolerite sills of the Karroo system of South Africa, and as the Antarctic dolerites that intrude the beacon sandstone formation of the Ross Sea region, they should probably be placed at the top of the Jurassic, and perhaps be connected with the breaking up of Gondwana Land at the close of Jurassic time.

They may, on the other hand, be of the early Cretaceous age, and connected with the diastrophism which was responsible for the great oceanic transgressions during Cretaceous times.

Cretaceous System.—This system is divided at present into the Rolling Downs formation below, and the Winton series (Cretaceo-Tertiary) above. The lower formation is almost wholly marine, except in the case of the Burrum coal-field of Queensland, with the adjacent Frazer Island (Great Sandy Island) and intermediate islands, which consist partly of freshwater beds. The Winton series is mostly of freshwater origin; but in places, as at Croydon, it contains in abundance *Rhynchonella croydonensis*, and at Fanny Bay and adjacent areas near Darwin is represented by a radiolarian shale, and by cherts containing casts of small *Belemnites*. The Winton beds vary from about 150 feet up to a maximum of 500 feet in thickness, while the Rolling Downs beds are in places about 2000 feet thick, perhaps more. The exact thickness is not always easy to determine, on account of a nearly conformable downward passage from Rolling Downs beds into Jurassic strata. The vast extent (about one-third) of the whole area of Australia, formerly covered by Cretaceous rocks shows that an enormous transgression of the ocean took place at this time, so as to develop a distinct epicontinental sea over the whole of east-central Australia. Cretaceous rocks are also developed on the NW. side of the Victoria Desert in Western Australia, as well as under the Tertiary limestones of the Nullarbor Plains fronting the Great Australian Bight, as proved in the Madura artesian bore. They are also represented at Perth by a narrow strip some thousand feet below sea-level, as is shown by the Clermont bore and the outcrop of white Cretaceous limestones and glauconites with phosphatic nodules at Gingin (60 miles N. of Perth) as well as by a similar strip extending along the coast from north of Geraldton towards North-west Cape.

The Cretaceous rocks of Gingin are specially rich in ammonites (six of which have affinities with *Haploceras daintreei*), *Inoceramus*, foraminifera and ostracods. The sponge *Peronella*, the coral *Coelosmilia*, and the brachiopods *Trigonesmus*, *Magas*, *Magasella*, etc., connect this Cretaceous fauna with that of the northern hemisphere. The marine fauna from this west-coast belt of Western Australia is closely allied to the Pondicherry Cretaceous fauna of India, and to that of South Africa; whereas that of the great artesian basin represents a peculiar type locally developed within this Australian Mediterranean. Lithologically the Winton rocks (formerly called desert sandstone) consist mostly of coarse sandstone that in the arid regions passes into quartzite, as well as of very siliceous white shales graduating superficially into porcellanite, and in places containing valuable deposits of precious opal. The latter are associated with remarkable large forms—known to the miners as 'pineapples'—of common opal pseudomorphous after glauberite, together with concretions—locally known as 'buns'—of barytes. Near Port Mackay in Queensland trachytic tuffs are said to be associated with the lower beds of the desert sandstone. This is the only record of contemporaneous volcanic activity in the whole Cretaceous system in Australia. Small seams of coal (too thin to be workable) and numerous silicified trees occur in places in this formation. The Rolling Downs strata are mostly friable sandstones rich in foraminifera, and rendered green by glauconite. In addition, on the Burrum coal-field and at Maryborough and Frazer Island sandstones and shales, with fossil plants and seams of productive coal, are now considered to be of Cretaceous age. The whole series is approximately 3000 feet thick. The Burrum coal-seams, of which about four are of workable thickness—that is, from three to four feet thick—contain coal of brittle, bright, black, bituminous character, remarkably free from ash, but too friable for export. The fossil plants recorded from this field show that forms like *Trichomanites laxum*, *Thinnfeldia media*, and *Taeniopteris daintreei* survived from Jurassic time. *Corbula burrumensis* and *Rocellaria terrae-reginae* are associated with the Burrum coal-measures. This recent discovery that part of the Australian Jurassic fauna and flora survived into Cretaceous time is obviously of considerable importance. The Styx River coal-field, 70 miles NW. of Rockhampton, contains several good productive seams up to five feet in thickness, and is considered to be of upper Cretaceous age and a little newer than the Burrum coal-measures. As regards the fossil fauna in the Rolling Downs beds, well-preserved remains of infusoria belonging to the Tintinnoidae, associated with diatoms and radiolaria, have been found in fine-grained limestones at Mitchell on the Maranoa River. The following is a list of specially characteristic fossils:—*Purisiphonia clarkei*, *Pseudavicula australis*, *Maccoyella barklyi*, *Nucula quadrata*, *Cytherea clarkei*, *Belemnites australis*, *Crioceras australe*, *Lamna daviesii*, *Aspidorhynchus* sp., *Belonostomus sweeti*, *Notochelone costata*, *Ichthyosaurus australis*, *Plesiosaurus macrospondylus*, *Cimoliosaurus*, *Aeschna flindersensis* (possibly an *Aeschnidium*), and many foraminifera, the Lituolidae being strongly represented.

The general evidence points to a progressive submergence of the Australian continent in Cretaceous time, leading to an encroachment of the sea southwards from the Gulf of Carpentaria across to the Bight. It is just possible that there may have been a narrow neck of land joining eastern to western Australia south of Lake Eyre. At all events, when the submergence was at its maximum, the isolation of eastern Australia from western Australia must have been nearly complete. The wide spread of the comparatively thin beds of the desert sandstone, mostly of freshwater origin, indicate that in upper Cretaceous time the Cretaceous seas were retiring from the continental area, and lacustrine conditions were taking their place everywhere—except locally, as at Croydon and Darwin. It may be added that Melville Island and Bathurst Island, N. of Darwin, are formed of Cretaceous rocks—apparently of Rolling Downs type; but little is as yet known of their fossil contents. The fact that lower Cretaceous fossils, especially small specimens of *Aucella*, *Scaphites*, *Histrichoceras*, etc., are being constantly washed up on the beach at the Point Charles lighthouse near Darwin shows that lower Cretaceous rocks underlie the strait which separates Melville Island from the mainland. It may be suggested here, very tentatively, that the vast transgression of the Cretaceous sea was perhaps causally connected with two other important geological events; the sinking in of Gondwana Land, leading to compensating uplifts of the sea-floor, and the wholesale injection of vast dolerite sills, which probably further contributed towards shoaling the ocean basins.

At the base of the Winton series (these

lowest strata being perhaps of the upper Cretaceous age) smoothed boulders, one at least striated by ice, are found in situ in a fine-grained shaly sandstone. Some are five feet in diameter. They are evidence of floating ice in late Cretaceous time. Small unproductive coal-seams occur in the series, conformably overlying the Rolling Downs formation, with a maximum thickness of 2000 feet. The Winton series which covers such a vast area of the great artesian basin is probably Cretaceo-Tertiary in age.

Cainozoic Era.—The classification and correlation of the rocks of the Commonwealth belonging to this era present many difficulties. It is harder in Australia than in northern Europe to separate the post-Tertiary from the Tertiary rocks. In northern Europe glacial deposits (chiefly of Pleistocene time) are widespread, but in Australia such glacial evidence is wholly restricted to an area of less than 500 square miles centring on Mount Kosciusko. Only in Tasmania can evidences of Pleistocene ice action be traced over a large area. Then, in regard to the correlation of the Australian Tertiaries with those of Europe, the statement of an Australian palaeontologist still applies:—'Many attempts have been made to fit the Tertiaries of southern Australia into the British Procrustean subdivisions, and I do not know that the results are any more satisfactory to the strata than they were to the guests of Procrustes himself.'

Direct comparison of Australian Tertiary forms with those of Europe may prove fallacious, unless supplemented by other evidence, for there is no direct proof of the existence of any highway for migration of marine organisms from the seas of the southern hemisphere into the *Tethys* area in early Tertiary time.

Tested by the Lyellian method—the determination of the percentage of recent mollusca in the series—the Tertiary marine faunas of Australia can be compared with the recent fauna of Australian seas; but it is now clear that some Australian palaeontologists who worked on these lines did not recognize that in many of our older Tertiary deposits the marine molluscan fauna is not, as was originally supposed, littoral in habit, but belongs to a moderate depth; and recent dredging operations have demonstrated the fact that many forms in the older Australian Tertiaries, formerly thought to belong to extinct species, are now living at some depths off the Australian coasts. If one relies for correlation on the evidence of wide-ranging and rapid-moving types, like sharks and whales, it may be noted that *Carcharodon angustidens* and *C. megalodon*, of the older Australian Tertiaries, are characteristically Miocene in the northern hemisphere. Then, too, the toothless whales of the Victorian older Tertiaries belong to a group which in the northern hemisphere appears to be chiefly Pliocene. On the whole the tendency of late has been to refer the so-called Eocene strata of southern Australia to some part of Miocene time. Recently it has been proposed to divide the Tertiary rocks of Victoria into four systems, based largely upon the correlation of various species of *Lepidocyclina*. The classification is as follows:—Werrikooian (upper Pliocene); Kalimnan (lower Pliocene); Janjukian (Miocene); and Balcombian (Oligocene).

The Balcombian series consists chiefly of sands and shelly marls. These contain an abundant marine fauna in which are represented fishes, polyzoa, echinoderms, gorgonids, corals, sponges and foraminifers. Intercalated with the marine series are freshwater deposits containing beds of brown coal of good quality and extraordinary thickness; a bore sunk at Morwell to a depth of 1000 feet passed through 888 feet of brown coal. These beds are probably of Miocene age, lying above the older basalt at the top of the Oligocene Balcombian formation and below the Janjukian limestones.

The Janjukian series, which is of Miocene age, consists largely of polyzoan (*Cellepora gambierensis* being specially characteristic) and *Lepidocyclina* limestones, and the same association has been noted in the deposits of South Australia. The Table Cape series of Tasmania has a well-developed *Turritella* horizon, in which the remains of a fossil whale have been found, as well as a very old type of marsupial (*Wynyardia bassiana*). Many of the Tertiary leaf-beds preserved in the deep leads of New South Wales (Dalton and Gunning) and Victoria (Bacchus Marsh, Narracan, Berwick, Pitfield, Cobungra, Dargo and Bobong) have been referred to the Janjukian series. The Nullarbor Plains, some 400 miles long and extending 300 miles inland from the cliffs facing the Australian Bight, are formed of a tough Janjukian limestone, rich in gastropods and polyzoa above, passing downwards into soft clayey sands containing subartesian water, in granite sands underlying lignitic estuarine silts and clays.

The Kalimnan series, regarded as of lower Pliocene age, are often largely formed of glauconite sands; these beds are well-developed at Beaumaris, where they consist of sandy marls in which occur numerous shells and the teeth of sharks. The fauna is chiefly molluscan, and is represented by such types as *Ancilla papillata*, *Voluta fulgetroides*, *Fusus gippslandicus* and *Trigonia margaritacea*. The plant-remains of the deep leads at Haddon in Victoria are referred to this period.

The Werrikooian series of upper Pliocene age comprises both freshwater and marine beds. The former is represented by the Dunolly gold drift, in which we have marsupial remains represented by *Phascolomys pliocenus*. The latter possesses a rich molluscan fauna, which includes a large percentage of living species. The remains of huge struthious birds (*Genyornis* and *Dromornis*) have been found in the Pliocene of Queensland, New South Wales and South Australia. This bird was as large as the moa of New Zealand.

Meanwhile the sequence of events in Cainozoic time along southern Australia and Tasmania, from the close of Cretaceous time, may be briefly stated as follows:—

Oligocene.—In the Port Phillip area in Oligocene time, the deposition of the Balcombian fluvio-marine series, at least 400 feet in thickness. This was followed by the outpouring of the older basalts and andesites, burying leaf-bearing, fluviatile and lacustrine deposits (the 'deep leads') under a thickness of 100 to 1300 feet of lavas and tuffs, developed chiefly in Victoria, New South Wales, and south-eastern Queensland. Tasmania was united to Australia at this time, and occupied by a primitive marsupial fauna neither distinctly polyprotodont nor distinctly diprotodont. *Wynyardia bassiana*, of the Tasmanian Miocene, was descended from this.

Miocene (Janjukian).—Development of marine, estuarine and lacustrine silts and clays, with beds of lignite, at Moorlands near Murray Bridge; near Adelaide; at Lal Lal and Morwell in Victoria (the lignites at the latter are 888 feet thick and full of *Callitris cupressiformis*,

the silver-barked mountain oak). The lignite deposits of Riverina belong to this series. The Moorlands lignites contain exquisitely preserved skeleton leaves of waratah and banksia. A deep and prolonged subsidence followed, affecting the whole southern coast of Australia and at least the northern part of Tasmania, the pre-Miocene Bassian land-bridge breaking down. North of the Australian Bight the middle Miocene sea crept inland for from 200 to 300 miles, soft marly strata with cherts and flints being followed by at least 200 feet of hard gasteropodan and polyzoal limestone, which now forms the surface of the Nullarbor Plains for a distance of at least 400 miles from east to west. At Norseman on Lake Cowan, at Cape Riche, and near Albany and up to the southern base of the Stirling ranges, the Janjukian strata are represented by deposits essentially of sponge-spicules (spongilite beds). East of the Nullarbor Plains the lands bordering Spencer and St. Vincent gulfs are partly formed (as at Point Turton and Aldinga) of beautifully preserved polyzoa and gastropods. The sea encroached far up the Murray to beyond Wentworth in New South Wales, while much of Victoria from Port Phillip to Gippsland was also submerged. In the river-eroded cliffs of the lower Murray *Cellepora gambierensis* forms sub-spherical masses, each of the size of a man's head. At Table Cape in Tasmania the Janjukian beds are about 80 feet thick, rich at their base in *Crassatellites*. In South Australia the polyzoal limestone is widely used as a building-stone, being soft enough in the quarries to be sawn with cross-cut saws, but hardening when weathered.

Older Pliocene (Kalimnan).—The southern shores of Australia began to rise. Shell-banks, specially characterized by *Ostrea sturteana*, were formed, associated with marls of shallow-water origin; but in places a considerable amount of glauconite was formed, pointing to local deep-water (100 fathoms or so) conditions. Among the whales *Scaldicetus macgeei* was characteristic. Some of the newer 'deep leads' (such as those of Gulgong in New South Wales, with *Plesiocapparis, Penteune clarkei, Meiolania*, etc., and the lacustrine beds of Launceston with *Spondylostrobus smythii, Plesiocapparis, Penteune allporti*, etc.) may perhaps be referred to this time. In Papua the Port Moresby beds, largely in the form of radiolarian cherts weathering in immense spheroids, are perhaps to be referred to some part of the older Pliocene. The immense belt of alkaline lavas and tuffs which extends from Casterton in Victoria through Mount Macedon, the Gib, Barigan (near Mudgee), the Warrumbungle and Nandewar ranges in New South Wales, and the Macpherson Range and the Glasshouse Mountains to Clermont, Springsure and Yeppoon near Rockhampton in Queensland—together with the Port Cygnet alkaline series, the nepheline-basanite of Table Cape, the melilite basalt of Sandy Bay near Hobart, the nepheline-melilite-basalt and nepheline-eudialyte-basalt of Shannon Tier in Tasmania—were erupted about this time.

Newer Pliocene (Werrikooian).—Further tectonic movements of the earth's crust caused elevations in some places, depressions in others. Spencer and St. Vincent gulfs were forming as the result of trough-faulting, much marine Pliocene material being deposited in St. Vincent Gulf, near the Croydon bore at Adelaide, and at Limestone Creek in the Glenelg River district of Victoria. Vast sheets of basalts, proceeding from dyke eruptions, then flooded the nearly even surfaces of the eastern and south-eastern Australian and Tasmanian peneplains. In South Australia they are represented at Kangaroo Island; in Western Australia at Bunbury, on the lower Blackwood River, and at Black Point on the coast. The fact that the flora of this period shows scarcely any trace of differentiation suggests that the land had a low relief. These extensive basaltic outflows appear to date near the close of Pliocene time.

Pleistocene (Kosciusko epoch).—In either very late Pliocene or early Pleistocene time the earth's crust, in the Australian and New Guinea region, was subjected to further considerable diastrophism. The eastern periphery of Australia (including Tasmania and the Mount Lofty and Flinders ranges of South Australia) was warped up to altitudes of 2000-3000 feet above the sea. The movement, being differential, carried an area such as Kosciusko to a height of 7000 feet above sea-level. Great subsidence and fracturing took place along the eastern coast of Australia, especially along the area of the Great Barrier Reef. In New Guinea the Cretaceous-Pliocene strata underwent intense orogenic movements, mountains being produced up to and over 15,000 feet in height. A glacial age supervened, which had many phases. Kosciusko was capped by an ice calotte from its summit to about 5000 feet above sea-level. In Tasmania the glaciation was naturally very heavy on the west coast and western highlands, the modern heavy rainfall, which comes from the west, being at that time largely replaced by snowfall. Not only were the Western Tiers of Tasmania and the highlands of the western coast covered with firn-fields and glacier ice, but at the township of Gormanston glacial boulder-clays were formed only a few hundred feet above sea-level, and on the western side of the Cray-croft Range moraine material descends to within 250 feet of sea-level. This glaciation affected (probably synchronously) New Guinea, and it was probably during a phase of this glacial age that the rhododendron migrated from Papua to the Bellenden Ker Range in Queensland (over 5000 feet high), where it has since become isolated through the amelioration of the climate. The phenomena of maximum glaciation seem to call for a lowering of temperature of approximately 9° Fahr., as compared with that of the present day.

Partly if not wholly synchronous with this ice age (or possibly with one of its interglacial phases, if there were any such), was an epoch when the central plains of Australia had a good rainfall, and the present area of internal drainage was only beginning to come into existence. Great herds of herbivores, of much larger size than their nearest modern allies, roamed over what are now the arid regions of the lower steppes near Lakes Eyre, Frome, and Callabonna. This fauna comprised *Ceratodus, Megalania prisca, Meiolania, Palimnarchus pollens, Diprotodon, Nototherium, Macropus*, and *Sceparnodon*, with the powerful carnivorous *Thylacoleo*, and the carnivorous *Thylacinus, Sarcophilus*, and *Canis dingo*. During this Kosciusko epoch New Guinea was still united to Australia, and the recent discovery of *Nototheria* (*N. tasmanicum* and *N. mitchelli*) at Mowbray Swamp in the north-western part of Tasmania, taken in conjunction with other evidence, suggests that Tasmania was once more united to Australia by way of the Bassian bridge. Gigantic ancestors of the emu, *Genyornis* and *Dromornis*, were

associated with this fauna; the birds were probably about 13 feet in height. A fine collection of this fauna is in the Adelaide Museum.

Along with the uplift there was, no doubt, a beginning of complementary subsidences, which became much more pronounced after the uplift ceased. The rift valleys of Torres Straits, Port Curtis, Cairns, Cooma, Bass Strait, Hobart, Port Phillip, St. Vincent and Spencer gulfs, Lake Torrens, and the west coast of Western Australia, gradually developed, together with those many faults traversing the highlands of the warped peneplains of Australia and Tasmania, whose unreduced scarps attest their comparatively recent origin. The recent volcanic craters of Mount Gambier, Tower Hill, etc., may be referred to this epoch. Possibly negritoid man entered Tasmania by way of the Pleistocene Bassian bridge before its final collapse. From the Kosciusko epoch to the present day canyon-cutting has been proceeding in the elevated peripheral portions of Australia and Tasmania, this process tending to push the divides farther inland.

Among recent formations may be mentioned the dune rock, partly cemented by lime, of Fremantle and the SW. coast of Western Australia, of Cape Northumberland near the border of South Australia and Victoria, and of Warrnambool, Sorrento, etc. At Sorrento this rock is about 1000 feet in thickness, and at least as thick near Perth. The heavy silting along the Victorian coast which has produced the Gippsland lakes, as well as the silting off the Maryborough coast, where the dunes are 800 feet high, and that between Shark Bay and North-west Cape in Western Australia, are all connected with the cusps of slack water formed next the shore, where great ocean currents meet. Mention may also be made here of the sand dunes of the lower steppes of Australia, and of the Victoria Desert. The latter are only superficially formed of loose sand to a depth of a foot or so; then the formation passes into a tough calcareous rock. In the Lake Eyre region, again, only the surface of the dunes is loose sand; inside they are formed of a certain amount of loamy material, especially near the old deltas of Cooper's Creek and of the Diamantina River. In most parts of central Australia these dunes derive their sand from the breaking up of the soft Jurassic and Permo-Carboniferous sandstones, as well as the Winton (desert) sandstones. The moving dunes of central Australia are of a bright brick-red colour.

In addition to the alluvial plains and rivers, mention may be made of the laterites (pindan gravels) of Western Australia, the nodular tuffaceous limestones (kunkar) of South Australia, the saline deposits of the inland plains, and the coastal salinas. It is clear that subsidence has been recently in progress at the southern end of Tasmania, and the large 'bank' recently discovered 200 miles farther south is obviously an immense sunken segment of a once greater Australia. Submergence has also taken place for a great distance along the eastern coast of Australia. As already stated, this is partly due to the recent melting of ice and snow in Antarctica, bringing about a universal rise of sea-level; but it cannot be entirely due to this, as the recent submergence is in places of the order of fully 200 feet, and it is doubtful whether the ice of Antarctica, from the great ice-age down to the present time, can have affected sea-level to the extent of more than about 100 feet.

The so-called 'raised beach' of about 15 feet is so general round Australia that it is probably due to a recent sinking of the sea-level. The 50-ft. raised beach near Darwin is probably connected with recent orogenic movements in New Guinea. These recent movements have caused a local emergence of the coral-reefs in south-eastern Papua of 1000 up to 2000 feet. The Great Barrier Reef of Queensland, some 1200 miles in length, represents in its uppermost portion a marvellous area of growing reef, the bulk formed of coral.

Earthquake shocks, most frequent in the area between the gulfs of South Australia, Bass Strait, and Kosciusko, show that coastal readjustment is still in slow progress in those regions. In New Guinea sharp shocks proceed from the active volcanic zone near Mount Victory. Many earthquake shocks which reach the eastern side of Australia emanate from the deep trench E. of the Tongan and Kermadec islands. Western Australia is practically free from earthquakes.

Prehistoric Man.—As is well known, the aboriginal inhabitants (now unfortunately extinct) of Tasmania belonged to the negrito race and were in a palaeolithic state of civilization. They had no knowledge of producing a cutting-edge on stone by grinding it down on a hone-stone; all their instruments were of the rudest possible type, and roughly chipped. Neither could they build canoes of the sea-going type, being satisfied to construct them from the bark of trees stripped off in long sheets, sewn up at the ends, and plugged with clay. In such frail craft they navigated their own rivers and lakes. In Tasmania no trace of aboriginal man has been found that considerably antedates the coming of the white man. On the mainland of Australia the aboriginal, as far back as we have any traces of him, had attained to a neolithic stage of civilization. The following appear to be the only evidences of the existence of man in Australia that approach high geological antiquity:—(1) The Tasmanian aborigines probably crossed Bass Strait (as they were ignorant of the art of making sea-going canoes) by an almost (if not quite) continuous land-bridge. (2) On the mainland of Australia there is possible evidence in some of the old cemented sand dunes near Warrnambool of impressions attributable to human bodies and feet. Many people, however, have doubted the genuineness of these imprints. In New South Wales several stone tomahawks were dug up a few years ago in the cutting of a canal at Shea's Creek, between Botany Bay and Redfern; these tomahawks were embedded in peat many feet thick, underlying marine estuarine beds at a total depth of 15 feet below high water. It may be concluded that the whole of our coast-line has subsided by 15 feet; or else, as the result of the melting of ice and snow in the Antarctic regions, sea-level has risen by that amount since the time when the aborigines lost their tomahawks in this swamp. In either case a considerable lapse of time, perhaps of the order of several thousands of years, would be needed to account for this change in the relative level of land and sea. (3) It has often been stated that stone tomahawks have been discovered in the deep leads of Victoria. The following, as far as is known, is the only case in which the tomahawk may possibly be considered as contemporaneous with the deep lead. Near Maryborough in 1855 a basalt axe-head was found four feet below the surface in one of the tributaries of the main Bet Bet

lead. The main lead is covered by basalt, believed to be of Pleistocene age; but the tributary lead, in which the axe-head was found, is not covered by basalt, so that the finding of an axe-head at a depth of only four feet does not necessarily imply any great antiquity for it. (4) If *Canis dingo*, as seems almost certain, was brought to Australia in canoes by early aboriginal man, man and the dingo—the latter a northern hemisphere type of wolf—arrived in Australia synchronously. Remains of dingoes in a cave at Mount Macedon show that it was contemporaneous with extinct marsupials. Therefore man, too, was probably contemporaneous with them in Australia and Tasmania. See ABORIGINES, ARTESIAN WATER, ANTARCTICA.

T.W.E.D.
L.A.C.

Geraldton Wax Flower. See CHAMAELAUCIUM.

Geraniaceae, a large family of herbs or shrubs found chiefly in northern temperate latitudes, but very abundant in South Africa; a few species are found in South America. Four genera with nine species are indigenous to Australia. The genus *Erodium*, abundant in Europe and North America, is represented by one endemic species (*E. cygnorum*), a biennial herb with deeply incised leaves and clusters of small blue flowers, popularly known as 'crowfoot' or 'stork's bill.' (See FODDER-PLANTS.) It extends across the continent. The genus *Pelargonium* is largely South African. There are 3 indigenous species. *P. australe*, a perennial herb with a stout rootstock, has two forms, one (with showy flowers) growing on the sandy sea-coasts, the other inland. The coastal form is more robust and larger in all its parts than the other, and its taproot descends to a great depth; it is of some value as a sand-binder. See GERANIUM.

Geranium, a widespread genus of the family Geraniaceae, consisting of herbs (rarely undershrubs) found chiefly in northern temperate regions. Four species are indigenous to Australia. *G. pilosum*, popularly known as 'crowfoot' (as are other members of the family) is found in all the States. It is known in Tasmania as 'native carrot,' and is highly prized as a fodder-plant. The barb-pointed fruits, however, cause irritation to sheep, and occasionally blind them, besides depreciating the value of the fleece.

Geum, a genus of the family Rosaceae, consisting of perennial herbs with yellow, white, or red flowers. The calyx-tube is short and open, 5-lobed; petals 5, broad, spreading; fruit a head of dry carpels surrounded by the persistent calyx, each carpel terminating in a thread-like awn. *G. urbanum*, found in eastern Australia, is the Avens or Herb Bennet of Britain. Its root, called by the old herbalists 'clover root,' has an aromatic clove-like odour; it possesses astringent properties, and has been used in cases of diarrhoea, etc.

Ghost Sharks (Holocephali) are distinguished from the true sharks by numerous structural details, the most obvious of which is the presence of but one gill-opening on each side as in the higher fishes; the mouth, too, is provided with bony grinders instead of teeth. The skin is quite smooth in most species, and there is a stout spine before the dorsal fin. The tail is usually prolonged into a long filament, and the male is provided with a peculiar bony hook on the forehead. Ghost sharks produce large eggs enclosed in horny cases of various forms. *Chimaera ogilbyi* is occasionally taken by trawlers on the New South Wales coast in depths of about 60 fathoms; when first caught it is a glistening silver in colour. Several other species are known from Australian waters. Elephant fishes (q.v.) belong to the same order.

A.R.McC.

Giant Cod. See ROCK COD.

Giant Lily. See AMARYLLIDACEAE.

Giant Maidenhair. See BURRAWANG and FERNS.

Giant Nettle. See LAPORTEA.

Giant Perch (*Lates calcarifer*), a widely distributed species, ranging from India and China through the Indo-Australian archipelago to northern Australia. Though essentially an estuarine fish, it commonly ascends rivers into fresh water, and often establishes itself in lagoons that can be reached only in times of flood. It is prized both as a food and as a game fish, attaining a length of nearly six feet, and weighing over 50 pounds. In parts of Queensland it is known as 'palmer,' and shares the native name of 'barramundi' with several other large freshwater fishes.

A. R. McC.

Gibber, an aboriginal word which signifies either a small stone or rock-ledge (the 'g' is hard). In the former sense it is usually applied to the small, polished, purple-brown stones, packed closely together, which cover a large part of the far-stretching plains of central Australia —known for that reason as 'gibber-plains' or 'gibbers.' These stones are formed by the gradual weathering of the quartzite caps of the flat-topped hills so common in that area. As the softer rock beneath is broken up, the stones fall close together, and are polished by the constant wearing action of wind-blown sand—especially during the dry season, when they are fully exposed to the elements. After rain they are partly protected by a rich growth of grass. When connoting a rock-ledge, the term is associated chiefly with the shelters ('gibber-gunyahs') which served many aboriginal tribes as homes and burial-places, notably in the Hawkesbury-sandstone district of New South Wales. These occur as recesses in the sandstone escarpments, each overhanging 'gibber' being a more or less tabular mass of rock often several feet thick. See CHATS and GEOLOGY.

Giblin, WILLIAM ROBERT (1840-1887), born at Hobart on 4 November 1840, and educated at the High School there, was called to the local bar in 1864, and entered politics as member of the assembly for Hobart in 1867. He was a member of the Wilson (1870-2) and Kennerley (1873-6) ministries; in 1877 he joined Philip Fysh (q.v.) as treasurer, taking the premiership next year, but for nine months only. Late in 1879, however, he formed a coalition ministry which lasted (mainly by absorbing successive leaders of the opposition) until 1884. He then left politics, took a puisne judgeship in 1885, and acted as chief justice from March to November 1886; in October-November of that year he administered the government after the departure of Sir George Strahan, being the first native-born Tasmanian to do so. He died on 17 January 1887. He represented his colony at international conferences in 1881 and 1883.

Gibney, MATTHEW (1838-1925), born in Ireland, was ordained priest on 14 June 1863, and in August of that year sent out to Western

Australia to work under Bishop Brady. In 1882 he was made vicar-general, and in 1886 coadjutor-bishop of Perth. Bishop Griver dying on 1 November in that year, Dr. Gibney was consecrated bishop of Perth in the cathedral of that city by Cardinal Moran on 23 January 1887. He retired from active work in 1910, and died at Perth on 22 June 1925. Outside his own State Dr. Gibney is probably most widely known from an incident that occurred during his visit in 1880 to the eastern colonies, to raise funds for the Western Australian orphanage. He happened to be near Glenrowan in Victoria when the gang of bushrangers under Ned Nelly (q.v.) seized that township and were attacked by a large force of police from Melbourne. His proposal to go straight to the hotel which the gang was holding, and do his best to induce them to surrender, was vetoed by the officer in command; but, when the hotel was seen to be on fire, he insisted on going into it to administer the last sacraments of the church to any bushrangers who might still be alive. Finding that all within the building were dead, he just managed to escape through the flames. The courage and piety thus displayed won him admiration throughout Australia. E.M.O'B.

Gidgee. See ACACIA.

Giffen, GEORGE, born in Adelaide on 27 March 1859, is the best all-round cricketer South Australia has produced. From 1876 to 1904 he played for South Australia regularly. His first appearance in test cricket was against Shaw's eleven of 1881-2, and he took part in test matches in 1882 (England), 1882-3 (Australia), 1884 (England), 1884-5 (Australia), 1886 (England), 1891-2 (Australia), 1893 (England), 1894-5 (Australia), and 1896 (England). In 1893 he headed the Australian bowling averages with 16 wickets for 21.37 runs, and in 1894-5 took 34 wickets for an average cost of 24.11, and was second in the batting averages with 52.88. His total score in test cricket was 1238 runs (average 23.35) and his bowling average 27.09 (103 wickets for 2791 runs). But outside test cricket some of his achievements were extraordinary. In the 1886 team he topped both the bowling and the batting averages; he made 18 centuries in first-class cricket; playing for his colony against Victoria in 1886, he took 17 wickets for 201; playing for South Australia against Lord Hawke's team of 1887-8, he took eight wickets (doing the 'hat trick') and scored only 118 in his two innings simply because he could get no one to stay with him; in 1891 he took 12 wickets for 192 in an intercolonial game, and in one innings made 237 runs; in a similar game in 1892 he took 16 wickets for 166, and in one innings made 271 runs. In 1884, playing in the Australian test team against the Rest of Australia, he took all the wickets in the second innings for 66 runs. Lord Hawke has called him 'dogged, skilled, shrewd . . . . the greatest Australian all-rounder.' In 1898 he published *With Bat and Ball,* a valuable series of sketches of Australian cricket and cricketers. Off the field he was employed in the public service (first of South Australia, after 1900 of the Commonwealth) in the postmaster-general's department, from which he retired with a pension on 27 March 1925. See CRICKET.

Gilbert, CHARLES WEB, born near Talbot in Victoria on 18 March 1867, was while still a boy apprenticed to a catering firm in Melbourne and set to mould figures in sugar-icing for wedding-cakes, etc. To improve his work the boy attended the art school attached to the Victorian national gallery, and soon determined to devote himself to sculpture. His first important work, 'The Vintage Offering,' was exhibited with the Yarra Sculptors' Society in 1897. For the next 16 years he worked steadily both on imaginative works and on a series of busts of notable Australians, including Alfred Deakin (bronze, in the library of the federal parliament), George Reid (marble, in the same library), Edward Holroyd (marble, in the library of the State law courts), and Bernard O'Dowd (bronze, in the Victorian national gallery). In 1914 he visited Europe, and for a time exhibited regularly at the Royal Academy; his head, 'The Critic,' exhibited in 1917, was purchased with funds of the Chantrey bequest for the Tate Gallery in London. In 1918 he was commissioned by the Commonwealth to execute models of battlefields in France in which Australian troops had been engaged, among them Pozières, Messines, Dernancourt and Mont St. Quentin. He has also designed the war memorials at Mont St. Quentin and Port Said, a colossal figure of an 'Anzac' for Broken Hill, many minor war memorials, and a statue of Matthew Flinders for Melbourne. His bronze 'Dreamer' is in the Melbourne gallery. W.M.

Gilbert. JOHN. See BUSHRANGING.

Giles, WILLIAM ERNEST POWELL (1836-1897, son of William Giles who was for 20 years general manager of the South Australian Company, was born at Bristol in England and educated at Christ's Hospital, and on leaving school in 1849 joined his family in South Australia. In 1852 he went digging on the Victorian goldfields; he then worked as a clerk in Melbourne, but, preferring an open-air life, obtained employment in reporting on new country west of the Darling (1864-5), and later joined an exploring party in Queensland. In 1872 he returned to his own colony and entered on the first of four important expeditions that opened up the country north-west of Lake Eyre and pierced the unknown desert lying between South and Western Australia. Details of these expeditions are given under EXPLORATION BY LAND; here it may be mentioned that the first (1872) traversed the area between Chambers' Pillar and Lake Amadeus, the second (1873-4) that between the Alberga River and the Tomkinson and Rawlinson ranges (these two were backed by Baron von Mueller and some wealthy Victorians), while for the third—which penetrated the desert westwards along the line of 30° S. lat.—and fourth—which went up the valley of the Murchison and along the line of 25° S. lat. to the central telegraph line at Peake Downs—Giles was supplied with camels and other necessaries by Sir T. Elder of South Australia. For these explorations Giles received the founder's medal of the Royal Geographical Society of London. His journeys of 1872-4 he described in a pamphlet published in Melbourne in 1875, and his transcontinental journeys in *Australia Twice Traversed,* published in London in 1889. He died at Coolgardie on 13 November 1897.

Gill, SAMUEL THOMAS (1820-1880), born in South Australia in or about 1820 and in his early years apparently a devotee of hurdle-racing, first came under public notice as a member of the ill-fated Horrocks exploring expedition of 1846, and had named after him the lake now known as Lake Dutton. In February

1847 his sketches of the country passed through were the principal attraction at an 'artists' exhibition' in Adelaide. In 1849 he published a dozen sketches of well-known colonists, his first venture in the line of polite caricature, and by this time seems to have been locally noted as a landscape painter. In 1851 he went to the Victorian goldfields, and in August 1852 published a series of 24 drawings made there; for the next three years he rapidly produced lithographs and water-colour drawings of Victorian scenery and notabilities; his work also reached London, the goldfields pictures being republished there in 1853 and a set of illustrations to Wilson's *Rambles at the Antipodes* in 1859. Between 1856 and 1862 he paid several visits to Sydney, occasionally staying at Hunter's Hill. But his headquarters were always in Melbourne, where he lived a spasmodic life of the kind considered 'artistic' in those days; no published work of his is known subsequent to 1865, and no water-colours later than 1874, but he was still living in 1880. On 27 October of that year he died suddenly on the steps of the general post-office. His principal works, besides those already mentioned, are *Diggers and Diggings of Victoria* (1855), a series of lithographs; *The Australian Sketchbook* (1855); *Scenery in and around Sydney* (1856), six lithographs; *Victoria Illustrated* (1857), views engraved on steel or copper; *Sketches in Victoria* (1860), 25 in number; a second series of *Victoria Illustrated* (1862); and a set of coloured lithographs illustrating bush life (1865). His work is valuable rather as reproducing the life and costume of his times than as art.

Gill, WILLIAM WYATT (1828-1896), born on 27 December 1828 at Bristol in England, and educated at Highbury College and the university of London (B.A., 1850), was in 1851 chosen by the London Missionary Society to take up missionary work in the Pacific islands. For 20 years he was stationed at Mangaia in the Cook group, but in 1872 established mission stations on the mainland of Papua, and in 1876—while on a visit to England—published *Life in the Southern Isles* and his best-known work, *Myths and Songs of the South Pacific*. Returning to the Cook group that same year, he worked on Raratonga until 1883, when his health gave way and he was forced to retire from active service and reside in Sydney. There for three years he revised his Raratongan translation of the Bible; he also published in London *Jottings from the Pacific* (1885) and—in conjunction with James Chalmers (q.v.)—*Work and Adventure in New Guinea* (1885; German translation issued at Leipzig in 1886). After a visit to London to see the Raratongan Bible through the press, he settled in Sydney, issued in 1892 a small pamphlet on *The South Pacific and New Guinea*, and died on 11 November 1896. For his literary work the university of St. Andrews made him LL.D.

Gill-birds. See WATTLE-BIRDS.

Gillies, DUNCAN (1834-1903), son of a Glasgow market-gardener, was born at Over-Newton in January 1834, educated at the Glasgow high school, and placed while still a boy in a local counting-house. In 1852 he migrated to Port Phillip and found his way to the Ballarat goldfield, where he became a leader among those disaffected to the government, but discouraged violence and refused to take any part in the Eureka Stockade affair. He was elected a member of the Ballarat mining court, and then of the board which in 1858 superseded that court, and in 1859 entered the Victorian assembly as miners' representative for Ballarat West. He was soon known as a good debater, but made no other mark until in 1867 he took a prominent part in opposing the grant to Sir Charles Darling (q.v.), and on 6 May 1868 took office in the short-lived Sladen ministry as president of the board of lands and works. His constituency at once rejected him, and in 1870 he was elected member for Maryborough, transferring himself to Rodney in 1877 and to the Eastern Suburbs (of Melbourne) in 1889. From 1872 onwards he was among the most prominent of the political leaders, administering the department of railways for the Francis (1872-4), Kerferd (1874-5), and two Service ministries (1880, 1883-6), and the department of lands for the McCulloch ministry of 1875-7; during the intervals—which were almost entirely occupied by Berry ministries (see BERRY, SIR GRAHAM)—he consolidated his position as a future party leader; and, when the second Service ministry, which was a coalition of the conservative (Service) and radical (Berry) parties, had to be reconstructed, Gillies replaced Service and became premier, with Alfred Deakin (q.v.) as his Berryite colleague. For the next four years he enjoyed a popularity and prosperity almost unexampled in Victorian politics. A swelling revenue enabled him to pursue a policy of expansion with regard to railways (of which he retained the administration), tramways, wharves and docks, while his colleague greatly extended the system of irrigation in northern Victoria; and by 1889 his accumulated surpluses amounted to over £1,600,000—more than a seventh of the year's income. But acute labour troubles, culminating in the maritime strike of 1890, destroyed the financial basis on which Gillies had erected an over-extravagant structure, and on 5 November 1890 his ministry fell. Relegated for a time to opposition, he was in 1894 made agent-general for the colony by J. B. Patterson, who had been his commissioner of customs in 1889-90; but he held the position for three years only, and on 14 October 1897 re-entered the assembly as member for Toorak, a seat which he retained till his death. On 14 October 1902 he was unanimously elected speaker. His health, however, was already precarious, and on 12 September 1903 he died of heart failure in the speaker's apartments.

Persistently interested in local politics—so that the agent-generalship was irksome to him—he was at the same time a strong supporter of federation, and represented his colony at several intercolonial conferences, at the federal convention of 1891, and on the federal council of 1885-9. In 1887 he refused a K.C.M.G.

Gipps, SIR GEORGE (1791-1847), born at Ringwold in Kent in 1791 and educated at the King's School, Canterbury, and the royal military academy, Woolwich, joined the royal engineers as second lieutenant in 1809 (1st lieutenant, 1809; 2nd captain, 1814; 1st captain, 1826; brevet-major, 1837; lieutenant-colonel, 1841). From 1811 he served in the Peninsular war, was wounded at the storming of Badajos, and for gallantry in this action was mentioned in despatches. In 1814 he joined the army in Flanders, and after Napoleon's escape from Elba was ordered to put Ostend into a condition of defence; he thus missed Waterloo. He remained with the army of occupation in France until July 1817; then, after a period of freedom spent in Euro-

pean travel, he returned to duty at Chatham, and in November 1824 was ordered to the West Indies, where he remained five years. His able reports on the subject of slave-emancipation brought him such credit that, on his return to England in 1829 to take command at Sheerness, he was appointed to two government commissions—one Irish, the other English—for the definition of electoral and municipal boundaries. In 1834 he became secretary to Lord Auckland, then first lord of the admiralty, and in 1835 was sent to Canada with Lord Gosford and Sir Charles Grey to investigate the colonists' alleged grievances. The sagacity and insight he displayed in this work won him the succession to Sir R. Bourke as governor of New South Wales, and he took up his duties at Sydney on 24 February 1838.

Gipps was an exceptionally able governor, but his administration was unpopular with all classes of the community, the difficulty of his position being increased by the fact that it was still the governor's duty to maintain the authority of the colonial office against the will of local political leaders. Both politically and economically the colony was in a state of transition during his administration. The demand for responsible government was already insistent, and could no longer be ignored. As a preliminary to the grant of a measure of responsibility, as well as on account of the defects of the system, the assignment of convict labour to private employers was limited in 1839 and abolished in 1841; meanwhile transportation to New South Wales was discontinued. It was hoped that the scarcity of labour resulting from the lack of convicts and from the rapid inflow of capital would be met by free immigration; this was conducted both under government control and on a bounty system, about 75,000 immigrants reaching the colony in the later thirties. Unfortunately a severe drought in 1839 was followed by a financial crisis, resulting from over-speculation in land; but, though unemployment was rife in the towns, immigrants were usually unwilling to go far inland, especially as the rate of wages offered by the squatters was very low. The squatters for their part attempted to force through the legislative council an arbitrary masters and servants amendment act; failing in this, because of official opposition, they again turned their attention to the possibility of obtaining Indian or Chinese coolie labour, and organized a Coolie Association in September 1842. This move was neither sanctioned nor encouraged by Gipps, who was strengthened in his attitude by the known opposition of the colonial office to an extensive importation of Asiatics. The labour issue led to a general shifting of class distinctions from a social (exclusive *v.* emancipist) to an economic basis, and Wentworth stood as a squatters' candidate at the election of June 1843 for the first representative council. There was no effective opposition at the poll, the franchise qualifications being too high for a strong democratic party; and the 12 official nominees found themselves confronted by 24 elected members, most of whom represented the powerful landed interest. Thenceforth Gipps was in continual disagreement with his legislative council, whose chief spokesman was Wentworth, already embittered against the governor for disallowing a claim to a large part of the south island of New Zealand (q.v.) when in 1840 the latter was formally annexed as a dependency of New South Wales.

The most serious causes of contention were the land regulations and the control of the land fund. By the British crown land sales act of 1842, land throughout Australia must be sold by auction at a minimum price of £1 an acre, the governor having power to increase this minimum for land close to township areas; Bourke's system of squatting licences was also sanctioned with modifications. The fund into which purchase-money and licence fees were paid was retained under control of the governor as representing the crown, to which colonial lands still belonged. The new council strongly opposed both the increase in the price of land and the provision in the licensing regulations which demanded a separate licence for each run instead of allowing several runs to be held under a single licence. But their chief object of attack was the governor's control of the land fund. Gipps was empowered by the colonial office to spend half this fund on assisting immigration, and the other half on the care of the aborigines, the construction of roads and bridges outside the settled districts, the maintenance of a border police force in the back country, and similar objects; any surplus was to be paid into the general revenue of the colony, which the council controlled. Wentworth demanded for the council control of the whole fund, and talked loudly of 'taxation without representation;' Gipps naturally defended the British position. There was trouble, too, over district councils. The act of 1842 provided for the establishment of district councils, which were to take over from the central government local roads, bridges, etc., paying expenses by means of rates levied in the district; but this instalment of local government was complicated by a provision that district councils should pay half the cost of the police, though the governor retained full control over that force. This provision further involved payment by the colony for the control of convicts who misbehaved after transportation, and the council contended that such expenses should be met from the British revenue. Consequently Gipps could do little towards the establishment of local institutions; and the squatter party, strengthened by the organization of a pastoralists' association, continued to oppose him until he left the colony.

While Gipps's firm rule antagonized the landed interests, it was hardly more satisfactory to the new immigrant group that was with difficulty organizing itself into a democratic party. Many immigrants had been members of Chartist associations in England, and had come to the new colony to find 'ample room to live in.' To their disappointment, the price of land had been raised beyond their powers of purchase, the financial crisis led to much unemployment in the towns, and opportunities offering in the country were not attractive. Gipps was not particularly sympathetic. He established a labour bureau, and developed certain public works, but ignored the immigrants' chief request—a return to the system of free land-grants on a community-settlement scale. As this, in the opinion of the radical leaders, provided the only means of escape from economic dependence, a Mutual Protection Association was formed in 1843 'by men robbed of their birthright, the franchise, holding their lives, liberties and properties at the will of the privileged classes.' The association lapsed, however, when the economic depression ended, and the 'new men' remained politically inactive until 1848.

Gipps had much to do besides withstanding his council. The residents of the Port Phillip

district, aggrieved at the remoteness of their administrative authority, demanded a separate government. The concession of representation by six members in the Sydney council did not appease them, for their business men could not spare time to attend the sessions. In 1844 all six members were residents of Sydney. When a motion for separation, proposed by one of the latter, was defeated in the council, they determined to apply direct to the colonial office, and Gipps strongly supported their contention. The governor was also burdened with aboriginals' complaints and misbehaviour. He knew that the colonial office had been giving anxious attention 'to the adoption of some plan for the better protection and civilization of the native tribes;' but he soon realized 'the extreme difficulty of devising any measure that shall effectually check the outrages which . . . are now of frequent occurrence beyond the boundaries of location' —outrages perpetrated both by settlers and by natives. One of his early duties was to order an inquiry into the conduct of a band of mounted police who, under shelter of their official position, had killed a number of aboriginals. Before the inquiry was complete, a particularly horrible outrage occurred, involving the massacre of between 40 and 50 friendly natives encamped on a cattle-station. Eleven white men were arrested and taken to Sydney for trial, seven being convicted and four acquitted. Mr. Justice Burton sentenced the seven to death, whereupon a great outcry arose among a section of the public 'who had become so accustomed to the common practice of shooting down the blacks in remote regions that they received a shock when that practice was treated as murder.' Gipps sent the men to the gallows, and outrages became less frequent—but the governor was more unpopular than ever.

During Gipps's term of office much valuable work was done in opening up the country; this is narrated in EXPLORATION BY LAND under the names of Strzelecki, Leichhardt, Mitchell, and Kennedy. The discovery of gold in these years by Strzelecki and Clarke is discussed under GOLD, DISCOVERY OF. But local politics—the training of New South Wales politicians for fuller self-government and the mastering of the over-hasty and unruly—was Gipps's chief concern; and, when in 1845 a new ministry in Great Britain adopted an entirely new attitude towards the colonies, it became time for him to retire. He had spent weary years in upholding against Wentworth and Lowe the authority of the colonial office which he served. But in 1846 the colonial office was intent on relieving itself of responsibility, even ready to give Australia its independence if asked for. Worn out and very ill, Gipps applied for permission to retire, and on 11 July 1846 sailed for England. Reverting to military employ, he was given command of the engineer depot at the Tower Hamlets, but before he could take it over died on 28 February 1847. (Kt. Bach., 1835.)

Gladstone Colony, THE. When in December 1845 W. E. Gladstone became secretary of state for the colonies he found that the disposal of convicts sentenced to transportation was an urgent problem; transportation to New South Wales had ceased, and Tasmania would soon be overfull. His predecessor, Lord Stanley, had envisaged a new penal settlement in the uninhabited northern regions of Australia, and Gladstone was attracted by the idea. First of all, however, he asked Fitzroy, then governor of New South Wales, for an expression of opinion on the resumption of transportation to New South Wales. Fitzroy published the despatch; a committee of the legislative council approved (guardedly) of the proposal; but the majority of the colonists showed themselves bitterly opposed to it. Gladstone thereupon proceeded with the foundation of a new northern colony, and selected Lieutenant-colonel George Barney (q.v.) as superintendent. The territory allotted to the colony was all New South Wales (as it then was) north of 26° S. lat., and its original population was to consist of emancipists and 'exiles' (i.e. prisoners released from English gaols on condition they accepted deportation to a colony for the rest of their sentence). The immediate procedure, said Gladstone, must include

(1) The selection of the best spot for a harbour, and for the town which might be expected to grow up in that locality.
(2) The immediate reservation there of such water frontage as ought to be open to general use, and of any sites which might appear requisite for public buildings or works of defence.
(3) The prompt distribution of the adjacent country into a sufficient number of lots to meet any probable demands of incoming settlers.
(4) The exception from such lots of any lands likely to be wanted for roads or other public purposes.
(5) The designation of the size of lots for the use of the two principal classes of settlers, and the manner in which the survey of both should proceed.

The name proposed for the settlement was 'North Australia.'

Barney reached Sydney on 15 September 1846, examined the coast of his new colony, and without much trouble decided that Port Curtis—a better if less picturesque harbour than Port Jackson—should be the site of his capital. Returning to Sydney, he chartered the barque *Lord Auckland*, which on 8 January 1847 sailed from Port Jackson with the pioneers of North Australia. They comprised Barney himself and his family; W. W. Billyard, chairman of quarter sessions; J. S. Dowling, crown prosecutor; E. C. Merewether, colonial secretary; G. H. Barney, clerk; assistant commissary-general Darling; Captain Day of the 99th regiment and his family, with 22 soldiers of the regiment; and about 40 civilians. The *Lord Auckland* was followed on 26 February by the barque *Thomas Lowry*, with several more families and 50 soldiers. On 25 January the *Lord Auckland* ran on a shoal at the entrance to Port Curtis, but was floated off on the 31st. On 30 January Barney and the other officers (who had landed soon after the vessel struck) were sworn in; an executive and a legislative council were proclaimed, and Captain Day was appointed police magistrate. The first days of the new settlement were not happy. 'We have three great evils,' wrote one of the pioneers, 'to contend with here—excessive heat, heavy rains and mosquitoes in millions, particularly in wet weather. We are thus in constant misery.' But relief was at hand. On 3 July 1846 Earl Grey had succeeded Gladstone as secretary for the colonies, and one of his first acts was to reverse the policy of his predecessor in regard to North Australia. On 15 November he wrote to Fitzroy intimating that the government had decided to abandon the newly-formed colony; Barney and his officers were to be recalled and employed in New South Wales. On 7 April 1847, therefore, the *Kangaroo* brought to the new settlement the news of its abandonment, and on 9 May the *Thomas Lowry* returned to Sydney with

a number of the officials and settlers. A memorandum from the audit office at Sydney, dated 31 March 1848, sets forth the cost of this short-lived colony as over £15,000.

Although the colony was wiped out of existence, the town of Gladstone grew up on the site of the experiment, and in 1854 Sir Maurice Charles O'Connell (q.v.) was appointed government resident, retaining the post until the colony of Queensland came into existence in 1859.

See J. F. Hogan's *The Gladstone Colony* (London, 1898.)

Glasswort. See CHENOPODIACEAE.

Globe-fish. See TOADOES.

Glover, JOHN (1767-1849), born at Houghton-on-the-Hill in Leicestershire on 18 February 1767, was the son of an agricultural labourer. His education was limited, and of art training he had none: but he taught himself to draw and paint, and in 1794 set up as a drawing-master at Lichfield. From 1795 onwards he exhibited at the Royal Academy; in 1805 he moved to London, was an original member of the Society of Painters in Water-colours (of which he was president in 1815), and before 1813 had become one of the most fashionable drawing-masters in the metropolis. After the restoration of the Bourbons in 1814 he visited Paris and gained the favour of both Louis XVIII and Louis Philippe, then Duke of Orleans. In 1824 he was a founder of the Society of British Artists. When he decided to retire from the active practice of his profession, he at first contemplated settling down on Ullswater in the Lake District, but finally decided to migrate to Tasmania: Louis Philippe commissioned him to paint pictures of Tasmanian scenery, but it is not known whether this was the reason for his decision. He reached Launceston on 18 February 1831, and settled —at the age of 64—on the northern slopes of Ben Lomond on a station which he named Patterdale. It is said that he and John Batman, in company, were the first Europeans to reach the summit of Ben Lomond. In 1835 he sent to England the pictures for Louis Philippe and several others, which were exhibited in London. He continued to paint until his death on 9 December 1849.

Glynn, PATRICK MCMAHON, born at Gort in Ireland on 25 August 1855, and educated at Trinity College, Dublin (B.A. and LL.B., 1880), was called to the Irish bar in 1880, but at once migrated to Australia and was admitted to the bar in Melbourne. Moving to South Australia in 1883, he was admitted to the bar in Adelaide in that year, and subsequently to the bar in Sydney. For about ten years he wrote for the Kapunda *Herald* and the Adelaide press, and in 1884 composed for the South Australian Land Nationalization Society a manifesto that stirred C. C. Kingston (q.v.) to bring in his bill for direct taxation on unimproved land values. In 1887 he was elected to the assembly as member for Light, but lost the seat by a few votes in 1889; from 1895 to 1901, with the exception of a few months, he was member for North Adelaide. In December 1899 he was attorney-general in the short-lived Solomon ministry. Always a supporter of inter-colonial federation, on which he wrote several pamphlets, he represented South Australia in the convention of 1897-8, and in 1901 was elected to the federal parliament from his State; in 1903 he became member for Angas in that parliament, and retained the seat until December 1919. In federal politics he took an independent part, following no particular leader, but was attorney-general in the coalition ministry of 1909-10, minister for external affairs in the Cook ministry of 1913-4, and minister for home and territories in the 'national' war ministry of 1917-20. Outside politics he has interested himself chiefly in constitutional law, in the disposal of the Murray waters (see IRRIGATION), and in the study of Shakespeare.

Gmelina, a genus of the family Verbenaceae, consisting of trees or tall shrubs with opposite leaves, and extending from the Caspian Sea to New South Wales. The flowers are often large, pink, pale purplish, or blue in colour; calyx 4-5 toothed or lobed; corolla-tube dilated upwards, the two upper petals sometimes united in a lip; stamens 4, in pairs, shorter than corolla; fruit a succulent drupe. *G. Leichhardtii* (White Beech), found in eastern Australia, is a tree 80-100 feet high with a diameter of 2-4 feet. It has handsome flowers, white with purple markings. The timber is strong, durable and easily worked; if moderately seasoned it does not unduly contract or expand, and is therefore valuable for decking vessels, flooring verandahs, etc. The fruits ('beech-nuts') are, when approaching maturity, frequently attacked by insects which destroy their fertility. This factor, in conjunction with the hardness of the seeds, reduces the productivity of the plants to such an extent that in certain districts the species is within measurable distance of extinction. *G. macrophylla*, occasionally known as Queensland Beech, is a tall tree with a prominently marked sapwood of a pretty purple colour.

Gnaphalium, a widespread genus of the family Compositae, consisting mostly of herbs with a coat of cottony down, known as cudweeds or cudworts. The flowers are rayless; floral bracts shining, in several rows; seeds oblong, with a pappus of capillary bristles. *G. purpureum* has a lax growth and flaccid leaves. The seeds are crowned by a comparatively large parachute of bristles; this, however, is not used for their dispersal, as the bristles are united in a ring by their bases and become detached from the fruit before the seeds fall.

Gnow. See MOUND-BIRDS.

Goanna. See LIZARDS.

Goat-fish or **Red Mullet,** members of the family Mullidae; a number of closely allied species of this family are known from Australian waters, and several are not uncommon, but they are not plentiful in the markets. They have two fleshy barbels beneath the chin, which have been likened to a goat's beard; these serve as tactile organs, and the young fish may be observed round wharf-piles with these members extended forward, feeling among the marine growths. All the family is richly coloured with brilliant reds and yellows, and with blue streaks and spots which scintillate as the fish struggles in its death-throes. It was fashionable among the Romans to have the fish brought alive into the dining hall, so that guests could feast their eyes upon its gorgeous and changing hues during the dying agonies. Red mullets have no affinity with the grey mullets (Mugilidae). A.R.McC.

Gobies, a very large group (Gobiidae) occurring in almost all waters, but usually of

such small size as to be commonly regarded as the young of larger species, or as too insignificant to merit attention. Their ventral fins are united to form a sucking-disk, by means of which they cling to stones, etc. They vary greatly in form and, occurring in both salt and fresh water, are modified to suit the diverse conditions of life on coral-reefs, sandy and muddy bottoms, estuaries, rivers, and even the isolated waterholes of central Australia.

A minute fish (*Gobius lidwilli*), plentiful around oyster-covered rocks near Sydney, is full-grown when little more than half an inch long, and bears the distinction of being one of the smallest vertebrate animals known. Some tropical and brightly coloured species of the genus *Gobiodon* are common among the branches of living corals, wherein they find shelter from their enemies; though they move with alacrity, they are so specialized to their strange environment as to become helpless when removed from their hosts. Over 50 species of gobies have been described from Australian waters. The mud-skipper (q.v.) is another member of the family. A.R.McC.

God-fern. See FERNS.

Gold. The discovery of gold in Australia—possibly the most epoch-making event in its history—is treated of in a separate article. Here are discussed the distribution of the precious metal throughout the Commonwealth, its chief modes of occurence, and the yields in recent years.

In the early years of gold-mining most of the gold was obtained—as might be expected—from alluvial deposits in shallow ground. When these were exhausted, resort was had either to deep leads—the beds of Pliocene and Pleistocene drainage channels, which still carried alluvial gold—or to auriferous reefs (usually of quartz) and to deposits of ironstone or of impregnated slate, tuff, etc. In New South Wales the beach sands of the northern coast, from Port Macquarie to the Queensland border, have yielded much gold in association with platinum and tin. The chief New South Wales fields have been Cobar (quartz) and the dredged areas of Adelong, Gundagai, and Araluen; this State produced its maximum in 1852, and of late years has yielded less than 7 per cent of the total Commonwealth production. Victoria, which produced its maximum in 1856, and for the 10 years 1852-61 averaged over 10 million pounds' worth a year, accounts for about 17½ per cent of the Commonwealth total; the famous Ballarat field has practically ceased to exist, and the chief producing districts are Bendigo (quartz), Beechworth (mainly quartz, but including a dredged area along the Ovens), and Castlemaine (mainly quartz). In the Bendigo district are the deepest mines in Australia, with shafts 4614 and 4318 feet deep. Queensland, whose annual output of late years has been about twice that of New South Wales, has depended almost entirely on the Mount Morgan field, which is separately described; alluvial deposits hardly exist, and the quartz reefs of Charters Towers, Chillagoe, and the Etheridge have either pinched out or do not pay for working. In South Australia the deposits, such as they are, are almost entirely alluvial, but this State has not produced in 70 years half as much gold as Western Australia yielded in 1920 alone. Tasmanian mining is almost entirely concerned with quartz reefs, though in the north-west a good deal of gold is won from copper ores. In Western Australia alluvial gold is now almost unknown. On the Yalgoo and Pilbara fields deposits of gold have been found in conglomerates of Cambrian age; but the principal auriferous rocks are probably pre-Cambrian and possibly Archaean, and in the lodes which they contain the gold is associated with pyrites of iron, copper, and arsenic, and sometimes with tellurium. The East Coolgardie field (i.e. Kalgoorlie and Boulder) has for a long time been by far the most productive, the Mount Margaret (Leonora and Laverton), Murchison, and Yilgarn fields lagging some distance behind; in 1921 East Coolgardie was responsible for over 70 per cent of the whole Western Australian yield. Native gold obtained from this field has been found 99.91 per cent pure.

Taking the Commonwealth as a whole, there have been two great periods of gold-production—1852-60, when the annual value of the yield averaged over 11½ millions sterling, and 1898-1911, when the annual average value was about 13¾ millions; in the first period Victoria produced about 87 per cent of the total, in the second Western Australia produced about 50 per cent of it. Since 1911 Western Australia has yielded over 60 per cent of the Commonwealth's total; during the same period Australia's proportion of the world's production has decreased from 11 to less than 5 per cent. The following figures (the latest available) are relevant:—

Gold won.	1922 fine oz.	Average 1912-21 oz.
New South Wales	25,222	101,524
Victoria	106,872	266,743
Queensland	80,584	191,753
South Australia	1,000	5,412
Western Australia	538,246	985,366
Tasmania	3,431	17,625
Northern Territory	115	1,560
Commonwealth	755,470	1,569,983

In New South Wales about 46 per cent of the yield comes from alluvial sources, nine-tenths of that being dredged. In Victoria 19½ per cent is alluvial, of which more than half is dredged. In the other States practically all the yield is from reefs or impregnated deposits.

Gold, Discovery of. The first authenticated discovery of gold in Australia is that of assistant-surveyor James McBrien, who recorded in a field-book (still in existence) on 15 February 1823 that near the Fish River between Rydal and Bathurst (N.S.W.) he found 'numerous particles of gold in the sand on the hills convenient to river.' In 1839 Strzelecki (q.v.) discovered auriferous pyrites near Hartley, just beyond the Blue Mountains. He furnished a report to the government on the subject, but stated that the pyrites yielded a very small proportion of gold, sufficient to attest its presence, insufficient to repay its extraction. Gipps asked him to keep the matter secret 'for fear of the serious consequences which, considering the condition and population of the Colony, were to be apprehended.' In a letter to Thomas Walker of Sydney, dated 16 October 1839, and published in the *Sydney Morning Herald* of 17 May 1851, Strzelecki wrote:—'On this side of the Dividing Range the variety of rocks and embedded minerals augment; indications most positive of the existing gold and silver veins are met with. The want of means however—that is, time and men—did not allow me to trace them to their proper sources. Why has the Government not sent heretofore a man of science and mineral-

ogical and mining acquirements to lay open these sources of wealth still hidden beneath, and which may prove as beneficial to the State and individuals as the rest of the branches of Colonial industry.'

On 13 and 14 February 1841 W. B. Clarke (q.v.) discovered gold in quartziferous slates in the main range west of Sydney, near the heads of Cox's River and the Winburndale rivulet. In 1842 he found gold on the Wollondilly; the next year he announced his discovery to various members of the legislature, and shortly afterwards made it known generally. On 9 April 1844 he reported the matter to Gipps, and showed him the gold; but again the governor was afraid of the consequences, and decided that it would be better to put the gold away. A shepherd named Macgregor found gold in the Wellington district in 1843-4, and Sir Thomas Mitchell took to England in 1847 a piece of quartz and gold brought to Sydney by this man.

Sir Roderick Impey Murchison in 1844 examined a collection of rock specimens brought from Australia by Strzelecki, and pointed out their likeness to the auriferous rocks of the Ural Mountains. In 1846 he wrote: 'I now learn however that fine specimens of gold have been found in the western flank of the Australian Cordillera, particularly at the settlement of Bathurst where it occurs in fragments composed of the same matrix (quartz rock) as in the Ural. My friend and associate at the Imperial Academy of Petersburg has recently suggested that a careful search for gold in the Australian debris will, it is probable, lead to its detection in abundance. I therefore encouraged the unemployed Cornish miners to emigrate and dig for gold.' These remarks, when circulated in Australia, encouraged a certain W. J. Smith, who was promoting iron-works near Berrima and wished to advertise the district, to send Murchison in 1848 some specimens of gold. In 1849 Smith exhibited to the colonial secretary a lump of gold embedded in quartz, and offered to show the government where he had found it if previously rewarded by the payment of a large sum. 'The obvious reply to his offer' as Fitzroy told Earl Grey, 'was that the Government could enter into no blind bargain on such a subject but that if Mr. Smith thought proper to trust to the liberality of the Government he might rely on being rewarded in proportion to the value of the alleged discovery, when that was ascertained. Mr. Smith refused to accede to the proposal and there the matter rested' (Despatch of 11 June 1851). The despatch says further: 'On the 3rd of April 1851 Mr. E. H. Hargraves, who had recently returned from California, addressed a letter to the Colonial Secretary to the effect that, having occupied himself for two months in exploring a considerable extent of country, in which, from his experience in California he was led to believe gold was to be found, he had prosecuted his speculation to a successful issue and offered to point out the localities where he had discovered gold to any officer the Government might appoint, on condition that the Government would award him the sum of £500 as compensation.' To this suggestion a similar answer was given, and Hargraves on 30 April expressed himself quite satisfied to leave the remuneration to the liberal consideration of the government, and disclosed the localities as '"'Lewes Ponds and Summer Hill Creeks,' 'M'Quarrie and . . . . . Rivers' in the districts of Bathurst and Wellington."' For the full account of Hargraves's discoveries see the article under his name.

The government geologist, Samuel Stutchbury, was then instructed to make a thorough examination of these localities, and on 14 May forwarded a report to the colonial secretary confirming the discovery. The news spread with amazing rapidity, and prospecting operations were immediately commenced all over the country with the result that a number of the principal goldfields were discovered the same year. This was an epoch-making event in Australian history, as a reference to the population figures prior and subsequent to the year 1851 amply demonstrates:—

Population of Australia,

1841	220,968	1851	437,665	1855	793,260
1850	405,356	1852	513,796	1858	1,050,828

Thus, while the average increase in population from 1841 to 1850 was about 20,000 yearly, the increase in 1851 was over 32,000, that in 1852 over 86,000, in 1853-5 over 93,000 yearly, and in 1856-8 nearly 86,000 yearly.

The Hargraves goldfield was one of the first to be discovered, and there in July 1851 the celebrated Kerr's Hundredweight (a mass of gold weighing 106 pounds) was found by an aboriginal shepherd in the outcrop of a quartz reef. Immediately afterwards a rush took place and extremely rich alluvial deposits were discovered. For a considerable period between 4000 and 5000 ounces of gold are said to have been sent away from the field every fortnight. Other important discoveries were made at Araluen (1851), Lambing Flat near Burrangong (1860), Lucknow near Orange (1863), Hill End (1872, though alluvial gold was known there much earlier), Yalwal (1873), Hillgrove (1888—but diggers had been on the field for many years before) and Wyalong (1893).

Victoria. In 1844 a man named Smyth thought he had discovered gold in Victoria near the Ovens River, and reported it to Superintendent Latrobe, who advised him to say nothing about it. Gold said to have been found by a shepherd in the Pyrenees Range was exhibited in a jeweller's shop in Melbourne in January 1848, and this induced C. Brentani (who had purchased the gold) to accompany the shepherd back to the Pyrenees: a number of diggers also went, but all failed in their search, and it is probable that the shepherd was an impostor. In 1849 auriferous quartz was found at Smythesdale, but nothing seems to have been done until after the discovery of the Bathurst and Turon workings in New South Wales, when apprehensions that the population of Victoria might drain off to the New South Wales diggings caused a committee to be formed in Melbourne on 9 June to promote the discovery of a goldfield in Victoria. In March 1850 W. Campbell of Strath Loddon found on the station of Donald Cameron of Clunes several minute pieces of native gold in quartz. This was concealed at the time, lest its announcement should bring undesirable strangers to the run; but on 10 June 1851 Campbell disclosed it. In the latter part of June a party headed by Louis John Michel discovered gold in quartz rock at Anderson's Creek, and on 16 July they brought to town a sample of alluvial gold from the same locality. On 1 July James Esmond, who had returned a few months earlier from California, obtained gold in the quartz rocks of the Pyrenees, near Cameron's station. Dr. George H. Bruhn—a German physician—had already found

indications of gold in quartz in April about two miles from Parker's station, and at Cameron's station had been shown specimens of gold from an area known later as the Clunes diggings.

Thomas Hiscock, a resident of Buninyong, on 8 August 1851 found auriferous quartz on the Buninyong ranges, in the gully now bearing his name, and communicated the fact to the editor of the *Geelong Gazette* on the 10th; this attracted great numbers of diggers to the neighbourhood, and so led to the discovery of Ballarat. The discovery of Golden Point is claimed by two parties, Turner's on 24 August and that of Connor and Brown on the 25th; the latter received official recognition. The first find at Mount Alexander is claimed by Christopher Thomas Peters, then a hut-keeper at Barker's Creek, who found gold on 20 July at Specimen Gully. On 1 September John Worley, a member of his party, 'to prevent them from getting into trouble,' published an account of their workings in one of the Melbourne journals. The Gold Discovery Committee awarded £1000 to Michel and his party; £1000 to Hiscock as the substantial discoverer of the Ballarat deposits; £1000 to Campbell as the original discoverer of Clunes; £1000 to Esmond as the first actual producer of alluvial gold for the market; and £500 to Dr. Bruhn in acknowledgment of his services in exploring the country and diffusing the information of the discovery of gold. They also recommended a grant of £5000 to Hargraves and of £1000 to W. B. Clarke. But these were recommendations only; Hargraves never received more than £2381, Campbell £476, and the rest got their rewards partly in 1855 and partly in 1861. The discovery of gold was all-important to Victoria, which was at the beginning of 1851 merely a pastoral settlement with a population of 77,345.

Immigrants now began to pour into the colony, and the story of the next few months can be best told by Latrobe. On 10 October he wrote to Earl Grey:

> Within the last three weeks the towns of Melbourne and Geelong and their large suburbs have been in appearance almost emptied of many classes of their male inhabitants; the streets which for a week or ten days were crowded by drays loading with the outfit for the workings are now seemingly deserted. Not only have the idlers . . . . and day labourers in town and country . . . thrown up their employments and run off to the workings, but responsible tradesmen, farmers, clerks of every grade, and not a few of the superior classes have followed. . . . . Cottages are deserted, houses to let, business is at a standstill, and even schools are closed. In some of the suburbs not a man is left, and the women are known for self-protection to forget neighbours' jars, and to group together to keep house. The ships in the harbour are in a great measure deserted: and we hear of instances where . . . . even masters of vessels, foreseeing the impossibility of maintaining any control over their men otherwise, have made up parties among them to go shares.

By the official figures at the time the amount of gold raised between 1 August 1851 and 6 December was:—

	Ounces
In banks at Melbourne	90,000
„ „ Geelong	30,000
Shipped, including 26,734 oz. already on the *Hero*	31,734
On the ground in merchants' or private hands	60,000
Total	211,734

At £3 per ounce that was worth £635,202.

Another despatch from Latrobe, dated 19 December 1851, says:

> The interval has been one of intense excitement in the community, and in effect this still continues. . . . The gold raised upon the Mount Alexander goldfields is now calculated by hundredweights, and arrives in the cities . . . . at the rate of probably two tons per week; so it has been at least for the last two weeks. Some 20,000 individuals are calculated to be congregated at the principal fields in that quarter, now four in number. . . . Since I last wrote the upper workings on Forrest Creek, prolific as they are, have been found equalled by others down the valley to its junction with Barkers Creek. . . On Friars Creek, five miles to the westward, an equally rich field has now been two or three weeks in working; and within a short period another ground at Bendigo Creek, to the north-east, on a branch of the Campaspe . . . . has been entered upon. Right and left throughout the whole region gold is found to exist. . . .

An official report rendered to Latrobe on 29 December states:—

> The Postmaster apprehends an entire disruption of the business of his Department, unless remedial measures can be taken. The Surveyor General is of a similar opinion. The Deputy Registrar thinks that all his subordinates will leave their occupation. The Supt. of Police states that, though in accordance with authority he offered high rates of pay to his force, fifty out of fifty-five constables have determined to go to the gold-fields; but his clerk and chief constables will remain. . . . The Crown Solicitor apprehends complete embarrassment. The Denominational School Board fears loss of teachers.

To prevent a complete disruption of the public service, increased rates of pay in all departments were promptly voted.

The general dislocation of society and of the whole machinery of the government was intensified in 1852 by the discovery of extensive goldfields in the remote Ovens district, the sudden rush of 20,000 to the McIvor and the creation of the town of Heathcote. The maintenance of order in the mining districts was, owing to the want of officials and the number of wild and lawless men who flocked to the diggings, almost impossible. By the time, says Turner, that Latrobe had made arrangements for police protection at Clunes, it was deserted in favour of Buninyong; as soon as a staff was organized for that place, the diggers flocked to Ballarat; and before the machinery could be got in order there, the thousands had melted to hundreds, and the process had to be commenced afresh at Forest Creek. Thence they streamed away to Bendigo, and out over the dry northern plains to Mount Korong, or on the west to Avoca and the Pyrenees, and on the east to the McIvor and the tributaries of the lower Goulburn. Meanwhile from the remote districts on the upper Murray, and the mountain fastnesses of Omeo, came tidings of swarming adventurers from the adjacent territory of New South Wales overrunning the land, gathering golden spoil, and refusing allegiance to Victorian authority. No wonder that the harassed governor had already informed the colonial office that however suitable the licensing system might be to the conditions of New South Wales, whence it was adopted, 'it never can be fully or satisfactorily carried out in this colony.' Yet he adds: 'While the Council is fully disposed to condemn the present licensing system, according to which the man who takes thousands from the ground and the man who is totally unsuccessful are presumed to pay alike, it is scarcely inclined to lend efficient aid to the collection of

a royalty upon the actual amount of gold realized by the successful adventurer.'

This licence fee, instituted in New South Wales in May 1851 and proclaimed in Victoria on 18 August, was first fixed at 30s. per month and afterwards reduced to 30s. per quarter. It was little felt as a hardship at first, when diggers were not numerous and generally successful; but, as time went on and the goldfields' population increased, many men were unsuccessful and payment became burdensome. The burden was increased by the methods of collecting it, which were too often objectionable; and the dissatisfaction and discontent culminated in a riot at Ballarat towards the close of 1854, described under EUREKA STOCKADE.

A royal commission subsequently recommended the abolishing of the licence fee, and made other concessions, the carrying out of which restored peace and harmony. Then the real good of the gold discoveries began to be realized; the population already mentioned as 77,345 in 1851 had increased to 231,925 in 1854, and in 1857 had reached 410,766.

Queensland. In 1853 Samuel Stutchbury, the government geologist of New South Wales, found gold near Port Curtis at the Calliope; this was the first authenticated discovery of gold in Queensland. Little appears to have been done, however, until in August 1856 a shepherd on Canning Downs brought in from 'Lord John's Swamp' 8 dwts. of gold. Gold was also found in that year at Emu Creek on the way to Gympie. But it was not until 1858 that payable gold was struck at Canoona (near Rockhampton) by an enterprising Cornish miner named Chapple. These alluvial deposits soon worked out, and the rush was attended with disastrous consequences. About 1862 residents at Gayndah offered a reward of £2000 to anyone who would find a payable goldfield, and it soon became known that in the country east from Eidsvold and Rawbelle alluvial gold could be got out in wet weather. At Ridgelands (about 21 miles from Rockhampton) a field was opened in February 1867—the discoverers received £250, the first reward of the kind ever paid in Queensland —and Ridgelands had hardly been opened before gold was discovered at Rosewood, where a patch of nuggets was found just below a slate bar.

Still, no really important discovery was made until in October 1867 a prospector named James Nash, making his way from Nanango to Maryborough, obtained several ounces of gold in a gully near what is now Gympie. Public announcement of his success being made on 16 October, hundreds of persons rushed to the new goldfield (Nashville, as it was then called), and with the discovery of a quartz reef on 8 November began the permanent prosperity of the field. In 1869 gold was found on the Gilbert River, and the Gilbert, Etheridge, and Woolgar fields were proclaimed; and on 26 January 1872 Hugh Mosman took up the first claim at Charters Towers. Other fields have followed—the Palmer, inland from Cooktown, in 1873, the Hodgkinson in 1875, Mount Morgan (see MORGAN, F. A.) in 1882, Croydon in 1886, the Hamilton field in 1899, and the Alice River in 1904.

South Australia. South Australia has the honour of having what is believed to have been the first authentic discovery of gold in Australia from which actual mining operations resulted. This took place in January 1846, about 10 miles east of Adelaide. In the early part of 1852 W. Chapman found very rich surface gold on the side of a hill above Donkey Gully; it was traced to Chapman's Hill, and found at the foot of a tree where it had been laid bare by the dripping of water from the branches. Half an ounce was picked up by dry fossicking, and on the following day several ounces were washed from the root of this tree. An offer of £10,000 reward for a payable goldfield had been published in the *Gazette* of 18 December 1851; the conditions were that licences (at that time costing 30s. each) to the value of £1000 must be taken out in the first two months, and that £10,000 worth of gold must be found in the same time. As Chapman could not prove that the second condition had been complied with, the executive council granted him and his friends £500.

About 1871 £200 and £300 were paid for discoveries of gold at Jupiter Creek. Gold has also been found in scattered patches along the main range from Echunga to Olary. The Teetulpa goldfield was discovered on 6 October 1886, and £300,000 worth of gold was obtained in an area of about a square mile; but the ground was soon worked out. A fair amount of gold has been won from reefs at Tarcoola (300 miles north-west of Port Augusta), and discoveries have been reported from the Peake and Denison ranges.

Northern Territory. In 1872 gold was found in payable quantities by the northern contractors for the overland telegraph line. Arltunga was the scene of a reported rich find in 1902, but the yield has since been small. In 1908 Driffield was the centre of production, and in 1909 a new field was proclaimed at Tanami, 450 miles south-east of Wyndham.

Tasmania. Fenton, in his *History of Tasmania*, says that before the Californian discovery a convict at Port Arthur offered to show a deposit of gold, but 'the Governor discountenanced the revelation, as he did not consider the colony ripe for such a discovery.' As far back as 1824 a man named Cobb, working in a road party at George Town, is said to have given Captain D'Arcy, then magistrate, a piece of metal; D'Arcy pronounced it brass, but Arthur gave Cobb a corner block in Launceston as a reward. Another authority speaks of gold having been traced near Nine Mile Springs (Lefroy) in 1849 by a resident of Launceston named Riva. The first important discovery seems to have been made about 5 February 1852, when Kicling Richardson, a shepherd, found gold in an alluvial deposit four miles from Fingal. Shortly after this Governor Denison prohibited the unauthorized taking of any gold metal or ore containing gold, and the digging and disturbing of the soil in search of gold. Small finds were also made at Tower Hill Creek and Nine Mile Springs, and in 1859 James Smith found gold at the Forth, and Peter Leete at the Calder. The quartz reefs of Fingal and Waterhouse came into prominent notice in 1869. These discoveries led to the appointment of two gold commissioners and the proclamation of two townships on the northern coast, Ducane and Lyndhurst. The Waterhouse reefs began to produce gold in 1871, but soon petered out and were abandoned. In 1877 the Tasmania gold mine was opened at Beaconsfield. But, though this mine has been successful, and discoveries have been made at Mangana (1870), Lisle (1878), Branxholm (1883), and other fields—including Mount Lyell (1886), more famous for its copper—none have been in any way extraordinary.

Western Australia. In the latter part of 1852

three or four parties were despatched east of York and Newcastle to seek for gold, but from climatic causes they were forced to abandon their search when within a short distance of the now well-known Yilgarn goldfield. Rich specimens of gold-bearing stone were found in 1852-3 by shepherds and others who were unfortunately unable to locate afterwards the places from which the specimens came. In March 1854 there was a reported discovery of gold at Cardup, 25 miles from Fremantle, but A. C. Gregory found the metal to be yellow mica and iron pyrites.

In the latter part of 1861 F. K. Panter, an inspector of police, while on a trip east of Northam, picked up several specimens of gold-bearing quartz. In 1862 the government engaged E. H. Hargraves (q.v.) to search for precious minerals through the settled districts of the colony for six months. Landing at Albany he prospected as far as Northam and through the Darling Range, but made a very unfavourable report, declaring that the formation of the area was such that gold would never be found in large and payable quantities in that area. Undismayed by this report, Western Australians continued their search for many years. In the government *Gazette* of 20 July 1869 £5000 reward was offered for the discovery of a payable goldfield within 30 miles of any declared port of the colony, and in 1870 a report was current that gold had been found at Blackwood. In 1871 alluvial gold was found by a shepherd at Peterwangy on the upper Irwin; in 1872 specimens from Kelmscott, Newcastle and Baylup were assayed at the Sydney mint and found to contain gold; in 1873 a party of Ballarat miners was engaged to prospect for precious metals, and the government erected a quartz-crushing mill at Fremantle. In the same year a quartz reef was found at Kendenup near Albany, which by Melbourne assays contained over an ounce to the ton. But no field was permanently established (though in 1882 A. McRae, when riding from Cossack to Roebourne, picked up a nugget of gold weighing 14 oz.) until in 1883 E. T. Hardman, the government geologist, first visited Kimberley, and on his return reported the existence of auriferous country on the western side of the Leopold Range.

Steps were taken to organize and equip a party to prospect the Kimberley district, and in August 1884 the legislative council placed £1000 on the estimates 'to be expended in prospecting for the discovery of a gold field;' but before the party started miners from the eastern colonies (Hall and others) had already arrived in the north-west, and on 30 August left Yeeda station on a branch of the Elvire; thence they prospected the Margaret and Ord rivers, finding gold on each. Carr Boyd claimed to have discovered a rich reef, and sent several hundredweight of the stone to Melbourne before Hall appeared, but after examination the government awarded £500 to Hall and his party. On 20 May 1886 the Kimberley goldfield was proclaimed. In 1887 Riseley and others found rich reefs 30 miles from Golden Valley, at a place they named Southern Cross. Two promising reefs were opened up in 1888 at Mallina, east of Roebourne, and in July a rich alluvial find was made at Pilbara Creek. The Yilgarn and Pilbara goldfields were proclaimed on 1 October 1888.

The Murchison (Nannine) goldfield was brought into notice by H. P. Woodward, the government geologist of the day, and in August 1891 J. F. Connolly reported the discovery of alluvial. In April 1892 Arthur Bayley and John Ford, after selling gold which they had secured at the Murchison, left Perth on a prospecting expedition. After many wanderings and no success they headed for Southern Cross, purchased supplies for seven or eight weeks, and in course of time reached the native well at Coolgardie, where they camped. In the morning Ford picked up a ¼oz. nugget, and before dinner-time they found over 20oz. of gold. During the next three or four weeks they secured by specking and dry-blowing over 200oz., and then were forced to return to Southern Cross for further provisions. They said nothing of their discoveries, but hurried back, and on the first Sunday afternoon after their return found the reef which soon became famous throughout the mining world. That evening they picked up and dollied with a tomahawk from the cap of the reef over 500 ounces of gold, and early the next morning pegged out a prospecting area. Bayley made his way to Southern Cross with 554oz., which he exhibited to Warden Finnerty on 17 September. The field was declared open, and Bayley left Southern Cross for Coolgardie again, accompanied by a coach, by teams, and a host of horsemen. The news quickly spread. The *West Australian* of 21 September says 'In Perth and Fremantle everyone seems to be either carrying tents, picks, shovels, and dishes or otherwise preparing for the road.'

Kalgoorlie (Hannan's) was discovered in June 1893, by Flannigan and Hannan, who were on the road with a party of about 150 men to a new 'rush' 50 miles north-east of Coolgardie. The party camped two days on the unsuspected field, waiting for water teams; as rain fell, they started on their way again, leaving Hannan and Flannigan behind. Flannigan, while looking for their horses, found a couple of nuggets and induced Hannan to remain with him; in a few days they picked up over 100oz., and on 17 June Hannan went back to Coolgardie and applied for a reward claim. Bardoc (the 45-mile) was located in August, and 'Siberia' in October. In 1894 Hall and Speakman pioneered the Mount Jackson district; rich alluvial was found at the Pinnacles in February, but the chief discovery of the year was the Kanowna alluvial ground, found by a digger known as Old Tom.

Bulong (the I.O.U.) was discovered in May —by two hitherto unsuccessful prospectors who were returning to Perth—the Norseman field in July, and the Lady Shenton at Menzies in September. Two of the richest finds of 1894 were the Wealth of Nations and the Londonderry. The Londonderry find was made, quite by accident, in June by an unsuccessful prospecting party who were on their way back to Coolgardie; rich quartz was picked up by two of the party, and after a brief search the outcrop of a reef was exposed, from which during the first three or four days they took between 4000 and 5000-oz. One specimen, Big Ben, was estimated to contain £3500 worth of gold. The Wealth of Nations was found in July, by J. G. Dunn, an old prospector. He discovered the outcrop of a reef 28 miles from Coolgardie. On breaking into the cap the quartz appeared to be glittering with gold; one of the first pieces taken out contained fully 800oz., and in a few days he secured gold to the value of over £20,000.

1895 was also a busy year—it was reported in January that over 2500 diggers were dry-blowing in the vicinity of Kalgoorlie. The Yal-

goo goldfield was proclaimed in January; in February a valuable discovery was made at Niagara; and early in the year the Hands Across the Sea reef claim was located at Kunanalling. At the end of the year there were 11 batteries, one cyanide plant, and 12 other mills working in the Coolgardie district, 17 batteries at Cue, 9 at Nannine and 2 at Mount Magnet; while during the first half of the year 73 Western Australian mining companies were incorporated in London, not to mention those floated locally and in the eastern colonies.

The Donnybrook district was opened up by Bourke and Hunter in 1898; Jackson's Claim at Donnybrook, and the Merton's Reward Mine, in 1899; in 1900 gold was discovered at Yundamindera and Mount Higgins (North Coolgardie), Willcena (Peak Hill), Ninghan (Yalgoo), Boodalyerrie Creek (Pilbara), Canvell, Reedy's and Weld Range (Murchison), and Yellowdine and Dunladgin (Yilgarn).

The impetus given to the colony by the gold discoveries may be gauged by the following figures:—

Year.	Inhabitants.
1890	46,290
1900	171,022

an increase entirely due to the gold discoveries.

Shipping.	Tonnage.
1861	57,456
1871	63,922
1881	145,048
1891	533,433
1898	1,194,894

Principal Nuggets found in Australia.

Name.	Date of Discovery.	Place of Discovery.	Gross Weight.	Value.
			oz.	£
Kerr's Hundredweight	1851	Turon River (New South Wales) ...	1,272	5,000
Sarah Sands	1853	Canadian Gully (Victoria)	1,619	5,532
Nugget	1853	Canadian Gully (Victoria)	1,117	7,500
Nugget	1853	Canadian Gully (Victoria)	1,011	.....
Lady Hotham	1854	Canadian Gully (Victoria)	1,177	.....
Nugget	1855	Blackman's Lead (Victoria)	1,034	3,250
Heron Nugget	1855	Mount Alexander (Victoria)	1,008	4,080
Nugget	1857	Dunolly (Victoria)	2,952 in two pieces.	5,500
Blanche Barkly	1857	Kingower (Victoria)	1,743	6,915
Welcome Nugget	1858	Ballarat (Victoria)	2,217	9,325
Nugget	1858	Burrandong (New South Wales) ...	1,286	4,389
Welcome Stranger	1869	Moliagul (Victoria)	2,284	9,534
Viscount Canterbury	1870	Berlin (Victoria)	1,121	4,000
Precious...	1871	Berlin (Victoria)	1,621	.....
Holtermann's Nugget	1872	Hill End (New South Wales)	7,560	12,000

Kerr's and Holtermann's were not, technically speaking, nuggets, but masses of gold found *in situ* in reefs.

Golden Perch or **Yellowbelly** (*Plectroplites ambiguus*) is an important food-fish, abundant in the whole Murray-Darling river system, and in the cismontane rivers of northern New South Wales and southern Queensland. A few specimens have attained a length of two feet and a weight of over 14 pounds. Its capture affords fine sport to anglers, and its flesh is excellent eating. A.R.McC.

Goldsbrough, Richard (1821-1886), born at Shipley in Yorkshire in 1821 and apprenticed to a wool-stapling firm in Bradford, started on a small scale as a wool-merchant in 1842, became interested in Australia as a wool-producing country, and in 1847 migrated to Adelaide and then to Melbourne, and commenced business at the latter place in 1848. The remarkable wool-clips of 1850 and 1851 enabled him to improve his position in spite of the excitement produced by the gold-discoveries, and in 1853 he established a stock and station business with Messrs. Row and Kirk as partners, and bought stations in the Riverina; but deciding after four years to confine himself to wool-broking, he steadily developed that business until in 1881, by amalgamation with another firm, he was able to found the house of R. Goldsbrough & Co. with a capital of three millions. He died on 8 April 1886; after his death the firm, whose Sydney trade had almost equalled its Melbourne success, absorbed the famous firm of Mort & Co. and eventually became, as Goldsbrough, Mort & Co., one of the greatest wool businesses in Australia. While taking no part in public life, Goldsbrough by his enterprise combined with sound judgment benefited the pastoral industry of Australia as much as his own fortunes.

Golf. This game was played in Victoria as far back as 1847, but no details of the play are extant. The earliest games recorded in Sydney were played in 1855 on links laid out between Homebush and Concord (two western suburbs of Sydney) somewhere near the existing Concord links. John Dunsmore, a Sydney solicitor, is credited with having brought clubs and gutty balls from St. Andrews to introduce the game in New South Wales, and some of these sticks and balls are in the possession of the Australian Golf Club at its Kensington headquarters. Nothing came of this first enterprise, and golf was forgotten in Australia until

in the winter of 1882 C. E. Riddell formed a club with links in Moore Park, Sydney. This, the Australian Golf Club, flourished until Riddell went to England in 1889, and held contests for a cup, named the Cadogan cup after its donor. In September 1895 a meeting convened by J. W. Fletcher and G. S. Yuill resuscitated the club and renewed the cup contests. The Australian Club's links have been in Moore Park (1882-9), Queen's Park (1895-9), at Botany (1899-1905) and at Kensington. In 1893 a second club, now the Royal Sydney Golf Club, was formed by Gerald Campbell and Irving Kent; its links have been at Yaralla near Concord (1893-4), at North Bondi (1894-7), and at Rose Bay.

In Melbourne the first club formed was the Melbourne Golf Club (now 'Royal') in 1891, with links at Albert Park and Caulfield (1891-7), Fisherman's Bend (1897-8) and Sandringham: up to 1897 the Australian championship was decided on this club's links. In South Australia a club was formed in 1870, playing on the East Park lands, but died in 1876. In 1892 a new club, the Adelaide Golf Club, was founded, with links at Peterhead near Largs Bay (since abandoned) and on the North Adelaide Park lands.

Golf is now played in all the Australian States, each of which has its own association controlling State championships and sending delegates to an Australian union; this body regulates the national open, and amateur events, and has a representative on the Rules of Golf Committee of St. Andrews. The season lasts from March to October, and the national championship meeting is held annually in August or September in Melbourne, Sydney, and Adelaide in rotation. The game is played also throughout the summer, when courses in the tourist districts, both mountain and seaside, are well patronized. The metropolitan courses, on which the championships are played, are generally well designed. The principal clubs are the Royal Melbourne and Metropolitan (Melbourne), Royal Sydney and Australian (Sydney), and Royal Adelaide (at Seaton, near Adelaide). The winners of the Australian Open and Amateur Championships are:—

Year.	Open.	Amateur.
1894	.....	L. A. Whyte.
1895	.....	R. A. A. Balfour Melville
1896	.....	H. A. Howden.
1897	.....	H. A. Howden.
1898	.....	H. A. Howden.
1899	.....	C. E. S. Gillies.
1900	.....	L. A. Whyte.
1901	.....	H. A. Howden.
1902	.....	H. Macneil.
1903	.....	D. G. Soutar.
1904	Michael Scott (a.)	J. D. Howden.
1905	D. G. Soutar ...	Michael Scott.
1906	Carnegie Clark ...	E. A. Gill.
1907	Michael Scott (a.)	Michael Scott.
1908	Clyde Pearce (a.)	Clyde Pearce.
1909	Claude H. Felstead (a.)	Michael Scott.
1910	Carnegie Clark ...	Michael Scott.
1911	Carnegie Clark ...	J. D. Howden.
1912	Ivo H. Whitton (a.)	H. Morrison.
1913	Ivo H. Whitton (a.)	A. R. Lempriere.
1914 to 1919	Not played ...	Not played.
1920	J. H. Kirkwood ...	E. L. Apperly.
1921	A. Le Fevre ...	C. Legh Winser.
1922	C. Campbell ...	Ivo H. Whitton.
1923	T. E. Howard ...	Ivo H. Whitton.
1924	A. Russell ...	H. R. Sinclair.

(a.) = amateurs.

The most notable Australian-born golfer who has participated in the British open championship is J. H. Kirkwood; he has recently secured a good professional appointment in America. Australians have contributed several books to the literature of golf, notably D. G. Soutar's *The Australian Golfer* (1906) and F. S. Shenstone's *Golf Rules and Decisions* (1924); and periodicals devoted to the game are published in Sydney and Melbourne. The growth of club membership and establishment of new courses have increased rapidly since the war ended.

T.T.

Gompholobium, a genus of the family Leguminosae, consisting of shrubs, with red or yellow flowers, endemic in Australia. The pod is oval to globular, inflated and slightly oblique. *G. grandiflorum* and *G. latifolium* are handsome shrubs with large, pale yellow flowers and tripartite leaves. *G. uncinatum,* a low spreading heath-like shrub, producing a profusion of attractive, brick-red flowers, is reputed to be injurious to stock. *Gompholobium* species are difficult subjects for cultivation.

Goodenia, a genus of the family Goodeniaceae, comprising 112 species of herbs or undershrubs endemic and widely distributed in Australia. The flowers are yellow, white or blue; calyx-tube 5-lobed and blended with the corolla-tube; the latter occasionally forms a spur at the base of the calyx, slit on the upper side, but in rare cases all the lobes are equal and spreading; stamens free; covering of the stigma cup-shaped; fruit a capsule, opening in two valves; seeds usually flat, with a thick border or membranous wing; leaves alternate, simple or incised, frequently in basal rosettes. *G. ovata,* a straggling undershrub with a slightly aromatic odour, is usually found in moist, shady situations. Its leaves are glossy, and exude a considerable quantity of resin. *G. stelligera* and *G. paniculata* are swamp-dwellers; the latter can survive a lengthy inundation. *G. decurrens,* with relatively large bright yellow flowers, grows in masses on the verge of dripping rocks in shady gullies. *G. barbata,* so named from the bristle-like hairs in the corolla-tube, has purplish wings attached to its corolla-lobes. Many species grow on the dry western plains.

Goodeniaceae, a family of almost exclusively indigenous plants, chiefly herbs, rarely undershrubs, with striking white, yellow, or blue flowers. It comprises 294 species, which are widely diffused over the continent. The calyx-tube is surmounted by 5 persistent lobes, small, united in a ring, or obsolete; corolla irregular, 5-lobed, their margins expanding into wings as the flower opens; stamens 5, alternating with the corolla-lobes; style simple, with a cup-shaped dilatation at the top enclosing the stigma; fruit a nut, drupe, or capsule opening in two or four valves. A feature of this family is the peculiar arrangement for the fertilization of the flowers. The female organ is covered by the cup-shaped dilatation of the style until it is ready to receive the pollen; brush-like hairs are so placed as to be ready to brush the pollen from the anthers on to the stigma when ripe; and the combination forms a complete apparatus for successful pollination. The genus *Brunonia* is limited to a single widespread but endemic species, *B. australis*—a silky-haired, perennial herb with a tuft of basal leaves, whose small flowers are crowded in a dense head at the top of a long flower-stalk. *Leschenaultia* is a western genus of herbs

or shrubs, the flowers of which are usually a brilliant blue, rarely white, red, yellow, or greenish. A sight of *Leschenaultia* country in

Leschenaultia splendens.

spring is a memorable recollection. *L. biloba* has a profusion of sky-blue flowers. *Calogyne* is a small genus with one representative in China. See DAMPIERA, GOODENIA, SCAEVOLA, SELLIERA, VELLEIA.

Goodenough, JAMES GRAHAM (1830-1875), born near Guildford in Surrey on 3 December 1830 and educated at Westminster school, in 1844 entered the navy (lieutenant, 1851; commander, 1858; captain, 1862) and saw service in the Pacific and Atlantic. In 1854-5 he served in the Baltic during the Crimean war, and from 1856 to 1861 was on the China station, taking an active part in several engagements of the Chinese war. By this time he had made his reputation as a scientific gunnery officer, and during the American civil war he was employed in watching gunnery developments in the northern States. After a period of service in the Mediterranean he was in 1871 placed on the admiralty committee on warship design, and a little later given experience as naval attaché in several European embassies. In May 1873 he was sent into the Pacific to command on the Australian station, with the rank of commodore—the station was not yet important enough to have an admiral—and found himself at once occupied with island affairs: he had to report on the expediency of annexing the Fiji group, and took Sir Hercules Robinson to complete the annexation and Sir A. Gordon to assume the governorship. In 1875 he visited the New Hebrides to promote friendly relations with the natives, and after success there proceeded to the Santa Cruz group with the same object; but on 12 August he was treacherously wounded with a poisoned arrow which produced tetanus, and died at sea on the 20th. He and two sailors who were wounded at the same time were buried in the burial-ground of St. Thomas's, North Sydney. (C.M.G., 1875; C.B., posthumous, 1879.)

Goold, JAMES ALIPIUS (1812-1886), born at Cork on 4 November 1812, educated there, admitted in 1830 to the order of St. Augustine, and ordained priest in 1835, met Dr. Ullathorne in Rome in 1837 and was induced by him to join the Australian mission. On his arrival in Sydney (on 24 February 1838) Dr. Polding made him assistant to Father McEncroe, and later on sent him to Campbelltown to succeed Father Therry. In July 1847 he was appointed to the new bishopric of Melbourne, consecrated on 6 August 1848, and installed on 8 October. In 1850 he laid the foundation-stone of St. Patrick's cathedral. For nearly 40 years he administered his diocese with skill and enthusiasm, procuring in 1874 the creation of two new dioceses—Ballarat and Sandhurst—and the elevation of Melbourne to an archbishopric. He took a very active interest in the education question as affected by local politics, and it was largely his influence that defeated Higinbotham's education bill of 1867 and ousted Berry at the elections of February 1880. In 1883 his life was attempted by his former solicitor. He died on 11 June 1886. E.M.O'B.

Gordon, ADAM LINDSAY (1833-1870), son of a military officer who had served in India and was afterwards professor of oriental languages at Cheltenham College, was born at Fayal in the Azores on 19 October 1833, and educated at Cheltenham, Worcester, and the royal military academy, Woolwich, also keeping a few terms at Merton College, Oxford. At none of these places was he a satisfactory student, and his exploits as a boxer and steeplechase rider so irritated his family that on 7 August 1853 he was sent off to Australia, armed with introductions to high society in Adelaide. He reached Adelaide on 14 November, and by the 23rd had enlisted in the mounted police and departed for his station, Mount Gambier. Two years later he resigned from the force and became a horse-breaker, leading a rather nomadic and lonely life in the Mount Gambier district, but establishing a valuable friendship with Julian Tenison Woods. In 1862 he married, and soon afterwards settled at Dingley Dell, half a mile from Cape Northumberland. In 1864 his first published verse appeared anonymously at Mount Gambier: it was a ballad entitled *The Feud*, written round six engravings of paintings by Noel Paton (originally made to illustrate that old ballad 'The Dowie Dens of Yarrow') which had been issued by the Royal Association for Promotion of the Fine Arts in Scotland. In 1864, too, he inherited £7000 from his mother, and was asked to stand in the anti-squatter interest for the electorate of Victoria in the south-eastern district of South Australia. In March 1865 he was elected, defeating the then attorney-general and bringing about the downfall of the Blyth ministry. In the house, however, he was not a success: his speeches were long, wandering, and full of unfamiliar classical

allusions, so that the *Telegraph* said:—'Lempriere has not been so hard-worked in this hemisphere for many a day as Mr. Gordon worked it on Tuesday.'

The two following years were probably the happiest of Gordon's life. He had a good income and a good position; he could indulge to the full in his favourite sport—horse-racing—and did so, winning the Adelaide Grand National on Cadger and the Ballarat Steeplechase on Ballarat; and, a demand arising for his manly, cheery doggerel (by no means all doggerel), *Bell's Life in Victoria* published in 1865-7 many racing pieces and 'Ye Wearie Wayfarer,' which contains most of the aphorisms that nowadays keep his memory green. At the end of 1866, however, he found his investments unsound and his career in parliament merely wearisome; he resigned his seat, and, after a short struggle to keep the South Australian home going on the proceeds of free-lance verse, migrated to Ballarat to take over the livery stables attached to Craig's hotel. About this time he published (at his own expense) his first important book of verse—*Sea Spray and Smoke Drift*—in Melbourne; but out of 500 copies printed he sold barely a hundred, and his next volume—*Ashtaroth*—was stillborn. He worked hard at the stables, and made himself popular as secretary of the local hunt club and in the local squadron of light horse; but he was no business man, and the partner he chose was less capable than himself. The firm was fast approaching insolvency when at the end of September 1868 he received from England a few small legacies and the news that he was the nearest male heir to the Scottish estate of Esslemont; also—and this pleased him much more—he created a record at Flemington on 10 October 1868, by winning three steeplechases in one afternoon, two of them on his own horses. Moreover in Marcus Clarke's newly founded *Colonial Monthly* he was hailed as the leading poetical genius of Australia.

On 1 October he had sold the stables, and began to depend on his riding for a living, winning many races during the following Christmas season, and bringing his family to Melbourne in the winter of 1869. Here he found for the first time since the Tenison Woods episode an intellectual companionship which might at an earlier date have inspired him to sustained and serious work. There was a ready market for his best verse in the *Colonial Monthly* and the *Australasian*; there was intimacy with Marcus Clarke and George Gordon McCrae and the Yorick club in general—Kendall was added later; there was a healthy life, full of swimming and riding. But at Ballarat he had been heavily thrown from a horse and had suffered injury to the skull, and a form of melancholia (the tendency to which he inherited from his mother) took hold on him. In March 1870 this tendency was aggravated by his being twice thrown in one race, a disaster which involved internal injuries as well as additional damage to the skull. Further, his attempts to secure the Esslemont estate failed utterly. He had at first neglected this matter, having no male heir to whom the estate might descend; but, when in January 1870 his claim was declared sound by an Edinburgh lawyer, he raised what cash he could and determined to prosecute it with vigour, incurring further debt on the strength of the income he expected to gain from it. In June the whole edifice collapsed, as it was discovered that a recent judicial decision put his case out of court. His new book of verse—*Bush Ballads and Galloping Rhymes*—seemed likely to involve him in more debt. On 23 June it was ready for publication, and he heard from the publishers what his liability was. This seems to have been the last blow. He met Marcus Clarke, full of congratulations; he spent two hours with Kendall, also eulogistic and comforting; but neither of them could dispel the fatal melancholia. Early the next morning he went out into the bush at Picnic Point on Port Phillip, and shot himself.

This tragic ending to a life of disappointments has somehow placed Gordon on a pedestal to which his actual literary work scarcely entitles him. In spite of Kendall's eulogy, he was never Australian, nor was his work; but he loved, and sang, life in the open and the virtues that naturally accompany it; and the manliness of his thought set to the lilt of his verse fascinated the young Australian spirit. To that extent—but to that extent only—he may be called, as Marcus Clarke calls him, the inaugurator of 'a national school of Australian poetry.' See LITERATURE.

Gore, WILLIAM, was born in England, but nothing else is known of his life until on 1 August 1805 he was appointed provost-marshal of New South Wales on the recommendation of the Earl of Harrington, then a general on the staff of the London district. The office was at the time not one of great importance; its previous holders had been a midshipman from the *Sirius*, a sergeant in the marines, and an acting-purser of H.M.S. *Buffalo*, and the salary attached to it was but five shillings a day; but King in 1806 described the provost-marshal as 'the ministerial officer of the executive authority and the courts of judicature,' his duties as comparable to those of a sheriff in England, and his position as one 'of great responsibility and trust in the present extended state of the Territory and its dependencies.' Gore left England with Bligh in the *Lady Sinclair*, and took occasion during the voyage to cultivate the new governor's friendship, so that after his arrival (on 6 August 1806) he was identified by the discontented settlers with Bligh's unpopular measures, and was one of the first to be imprisoned and tried by Johnston and his fellow-mutineers in 1808; indeed, in the previous year (1807) he had been the victim of false charges of theft and illegal uttering, and Johnston in his account of the mutiny described him as 'abandoned and unprincipled.' The mutineers imprisoned him for two months, tried him on a charge of perjury (to which he refused to plead, challenging their jurisdiction) and sentenced him to seven years' transportation to Newcastle; but on the arrival of Macquarie he was set free and sent to England as a witness on Bligh's behalf, Johnston also demanding his presence as one of the principal agents of Bligh's 'tyranny.' In May 1812 he returned to New South Wales and resumed office, but in July 1814 was thrown out of work by the action of Jeffery Hart Bent (q.v.) in suspending all legal proceedings in the civil courts. It would seem that the provost-marshal had a right to certain fees or perquisites while actively engaged in his duties, for Gore in 1817 complained to the colonial office that for 7½ years of his term (1808-12 and 1814-7) he had received nothing but his bare pay. By this time, however, he had fallen into disrepute, his salary was assigned to creditors, and he himself, after attempts to evade arrest, had been

committed to a debtors' prison, had escaped therefrom, on 6 March 1819 was on the recommendation of the judges suspended from office, and in 1820 was removed from it. Retiring to his home on Gore Hill, he lapsed into drunken habits, and on 19 January 1824 was convicted of having shot at and wounded a soldier who was trespassing on his property; Brisbane, however, pardoned him, and he lived in obscurity until his death. This did not take place until 1845, probably to the great regret of Lord Palmerston, who in 1823 enquired anxiously whether Gore had yet 'paid the Debt of Nature,' as he was 'a last Life in an old Irish Lease.' Brisbane, who lacked a sense of humour, took the enquiry for a mark of Palmerston's interest in Gore, and it was partly because of this that he granted the pardon.

Gosse, WILLIAM CHRISTIE (1842-1881), born in 1842 at Hoddesdon in Hertfordshire, was in 1850 brought by his father to South Australia, educated privately in Adelaide, and at the age of 17 enrolled as a cadet in the surveyor-general's department and sent to the far north of the colony. His early experience of this region was remembered when in 1873 the South Australian government, stimulated thereto by the explorations of John Forrest and Ernest Giles in the area west of the overland telegraph line, decided to despatch an expedition into the unknown lands west of the Macdonnell Ranges. Gosse, given command of the expedition, started from Alice Springs on 23 April 1873 and managed to reach the Townsend Range, about 100 miles within the Western Australian border, but was then forced to turn back; a little later in the same year Giles was blocked almost at the same place. As a reward for his work Gosse in 1875 was made deputy surveyor-general, but his health failed, and he died prematurely on 12 August 1881.

Goulburn, HENRY (1784-1856), born in London on 19 March 1784 and educated at Trinity College, Cambridge (B.A., 1805; M.A., 1808), entered politics in 1807 and in 1810 was made under-secretary for the home department. In 1812 he was transferred to the department of war and the colonies, succeeding Sir Robert Peel there as under-secretary and holding the post (under Bathurst as secretary) until December 1821. He was afterwards chief secretary for Ireland (1821-7), chancellor of the exchequer (1828-30 and 1841-6), and home secretary (1834-5); from 1831 to 1856 he represented the university of Cambridge in parliament, and Oxford made him a D.C.L. in 1834. Although the policy of the colonial office in regard to New South Wales was nominally Bathurst's, Goulburn's intimate knowledge of its affairs, stimulated by his long and elaborate correspondence with Macquarie, made him an important influence on Australian development. The Goulburn River in New South Wales and the town of Goulburn in the same colony were named after him. He died at Dorking in Surrey on 12 January 1856. (P.C., 1821.)—His younger brother FREDERICK GOULBURN (1788-1837), joined the army in 1805 (cornet, 1805; lieutenant, 1806; captain, 1810; major, 1816; lieutenant-colonel, 1836) was present at Waterloo, and on 30 June 1820 was appointed colonial secretary of New South Wales. Here he fell foul of the judge-advocate, and of the governor, by claiming privileges and an independent discretion that were not actually justified by his position; in December 1824, therefore, he was recalled. Although his conduct in the colony had been condemned by Bathurst, he had influence enough in England to secure on his return an appointment as under-secretary for Ireland, and the offer in 1829 of a colonial governorship; this he refused, preferring to retire into private life. He died at Southgate in May 1837. The Goulburn River in Victoria was named after him.

Gould, JOHN (1804-1881), son of a working gardener, was born at Lyme Regis in Dorset, England, on 14 September 1804. From early youth he was interested in wild bird life and skilful in taxidermy. At 14 he worked under his father, who had just become a foreman gardener at Windsor Castle. In 1827 he was appointed taxidermist to the Zoological Society of London; and three years later, receiving from the Himalayas a collection of bird-skins, produced his first volume of bird illustrations, the *Century of Himalayan Birds*—which he had to publish at his own expense. In 1837 he published a *Synopsis of the Birds of Australia* with 72 plates, and in 1838 went himself to Australia with strong recommendations from the colonial office. There he spent two years in collecting and in the instruction of subordinate collectors, and personally explored a great part of New South Wales, South Australia, and Tasmania. On his return to England in 1840 he commenced the publication of his great work on Australian birds in seven volumes, containing 601 plates. He was sadly hampered during the next few years by the loss of several of his Australian collectors. John Gilbert, who had accompanied him from England, and had made collections in Western Australia and at Port Essington and Moreton Bay, was killed by natives during the Leichhardt expedition of 1844; Johnston Drummond met the same fate in Western Australia, and F. Strange in the Wide Bay district of Queensland in 1846; and a collector obtained for him by Sir John Franklin was accidentally shot on an island in Bass Strait. Sir John, then governor of Tasmania, took great interest in Gould's researches, and his youngest son—Charles Gould, afterwards Tasmanian government geologist—was born at government house, Hobart. The collection of Australian birds—1800 specimens—was offered for £1000 to the British Museum (Gould's out-of-pocket expenses had amounted to double that sum), but was rejected: it was then bought by Dr. Wilson of Philadelphia, and by him presented to the Philadelphian Academy of Natural Science. The rejection by the British Museum—which at first sight would seem inexplicable—has been cleared up by a discovery of G. M. Mathews (see his *Birds of Australia*, ix. 105-6) that many of Gould's type-specimens had already been either presented to the museum by Gould or bought by the trustees from him.

It was not only the birds of Australia that interested him. In 1844 he brought out a *Study of the Macropodidae* (*Kangaroos*) with 45 plates, and between 1845 and 1863 produced three volumes on *The Mammals of Australia* with 182 plates. The seventh volume of the *Birds of Australia* appeared in 1848, and in 1851 he began to issue in parts a supplementary volume with 81 plates, the last part of which appeared in 1869. The magnificent plates of this series, in which a large proportion of the birds are represented life-size and with backgrounds of characteristic Australian vegetation (sketched by the author and his wife in Australia), make it one of the most important works on birds ever produced.

Meanwhile he had issued in 1865 a two-volume *Handbook to the Birds of Australia*, in which about 660 species are described; of these a considerable number are now regarded as merely geographical races or sub-species, but in the succeeding 50 years only about 100 more have been discovered, and many of these are rare or casual visitors from oversea. These three books —the *Synopsis* of 1837-8, the *Birds* of 1840-69, and the *Handbook* of 1865—must be carefully distinguished. His last contribution to Australian zoology was *The Birds of New Guinea and the Adjacent Papuan Islands* (141 plates), published between 1875 and 1880, and completed after his death by R. B. Sharpe of the British museum.

Gould's work was by no means confined to Australia. His total output was 41 folio volumes, illustrated by 2999 plates, as well as 300 memoirs and papers for various scientific journals. The more important volumes, apart from those already mentioned, are *Birds of Europe* (449 plates, 1832-7), *Monograph of the Trochilidae or Humming-Birds* (360 plates, 1849-61), *The Birds of Asia* (497 plates, 1860-80), and *The Birds of Great Britain* (367 plates, 1862-73). In 1843 he was elected a fellow of the Royal Society. He died in London on 3 February 1881.

Gould was a man of simple, kindly nature, with a passion for his work. He loved to be called 'The Bird Man,' and that is his best epitaph. But his work cannot be dismissed so lightly; apart from its mere volume—which, as the above account has shown, was very great —his study of so many life-histories of birds, and his discovery of the nesting habits of the megapodes (see MOUND-BIRDS) and the even more remarkable structures of the bower-birds (q.v.), rank it among the really great contributions to our knowledge of nature. His wife, a Miss Coxen, whom he married in 1829 and lost in 1841, was an excellent assistant, and while she lived undertook the transference of his sketches to the lithographic stone for printing, besides (as has been already mentioned) helping in the preparation of the sketches themselves.

Gouty Stem. SEE BOTTLE-TREE.

Government Bream. See SNAPPER.

Governors-General, Governors, and Administrators. (The official designation in each case, if not attached to the name, is the same as that of the immediate predecessor. Terms of administration during short absences of a governor-general or governor are not recorded.)

COMMONWEALTH OF AUSTRALIA

FROM	TO	NAME
29 October 1900	9 January 1903	HOPETOUN, Earl of (John Adrian Louis Hope), P.C., K.T., G.C.M.G., G.C.V.O., afterwards Marquess of Linlithgow, Governor-General and Commander-in-Chief of the Commonwealth of Australia. (From 17 July 1902 to 9 January 1903 Lord Tennyson acted as Governor-General.)
9 January 1903	21 January 1904	TENNYSON, Baron (Hallam Tennyson), G.C.M.G.
21 January 1904	8 September 1908	NORTHCOTE, Baron (Henry Stafford Northcote), P.C., G.C.M.G., G.C.I.E., C.B.
9 September 1908	31 July 1911	DUDLEY, Earl of (William Humble Ward), P.C., G.C.M.G., G.C.V.O. (From 21 December 1909 to 27 January 1910 Lord Chelmsford acted as Governor-General.)
31 July 1911	18 May 1914	DENMAN, Baron (Thomas Denman), P.C., G.C.M.G., G.C.V.O.
18 May 1914	5 October 1920	MUNRO-FERGUSON, Sir Ronald Crauford, P.C., G.C.M.G., afterwards Viscount Novar of Raith.
6 October 1920		FORSTER, Baron (Henry William Forster), P.C., G.C.M.G. Governor-General designate: STONEHAVEN, Baron (Sir John Lawrence Baird), P.C., G.C.M.G., D.S.O.

NEW SOUTH WALES

26 January 1788	10 December 1792	PHILLIP, Captain Arthur, R.N., Governor-in-Chief of New South Wales. (From 11 December 1792 to 12 December 1794 Major Francis Grose, and from 13 December 1794 to 11 September 1795 Captain William Paterson, administered the settlement.)
11 September 1795	27 September 1800	HUNTER, Captain John, R.N., Governor of New South Wales and its Dependencies.
28 September 1800	12 August 1806	KING, Captain Philip Gidley, R.N.

From	To	Name
13 August 1806	26 January 1808	Bligh, Captain William, R.N., Captain-General and Governor-in-Chief of New South Wales and its Dependencies. (During the illegal suspension of Governor Bligh the colony was administered by Major George Johnston from 26 January to 28 July 1808; by Major Joseph Foveaux from 29 July 1808 to 8 January 1809; and by Colonel William Paterson from 9 January to 31 December 1809.)
1 January 1810	1 December 1821	Macquarie, Colonel Lachlan, afterward Major-General.
1 December 1821	1 December 1825	Brisbane, Major-General Sir Thomas Makdougall, K.C.B. (From 1 to 18 December the colony was administered by Colonel William Stewart.)
19 December 1825	21 October 1831	Darling, Lieutenant-General Ralph. (From 22 October to 2 December the colony was administered by Colonel Patrick Lindesay, C.B.)
3 December 1831	5 December 1837	Bourke, Major-General Sir Richard, K.C.B. (From 6 December 1837 to 23 February 1838 the colony was administered by Lieutenant-colonel Kenneth Snodgrass, C.B.)
24 February 1838	11 July 1846	Gipps, Sir George, Kt. Bach., Captain-General and Governor-in-Chief of New South Wales and Van Diemen's Land and their Dependencies. (From 12 July to 2 August the colony was administered by Sir Maurice Charles O'Connell.)
3 August 1846	17 January 1855	FitzRoy, Sir Charles Augustus, K.C.H., Governor-General of all Her Majesty's Australian possessions, and Captain-General and Governor-in-Chief of New South Wales, Van Diemen's Land, and South Australia, and their Dependencies.
20 January 1855	19 December 1855	Denison, Sir William Thomas, K.C.B., Governor-General of Her Majesty's Colonies of New South Wales, Tasmania, Victoria, South Australia, and Western Australia.
19 December 1855	22 January 1861	Denison, Sir William Thomas, K.C.B., Captain-General and Governor-in-Chief of New South Wales and its Dependencies and Vice-Admiral of the same. (From 22 January to 22 March the colony was administered by Lieutenant-colonel John Francis Kempt.)
22 March 1861	24 December 1867	Young, Sir John, Baronet, P.C., K.C., G.C.M.G., afterwards Lord Lisgar, Captain-General, Governor-in-Chief and Vice-Admiral of New South Wales and its Dependencies. (From 25 December 1867 to 7 January 1868 the colony was administered by Sir Trevor Chute.)
8 January 1868	22 February 1872	Belmore, Earl of (Sir Somerset Richard Lowry-Corry), P.C. Ireland, G.C.M.G., Governor and Commander-in-Chief of the Colony of New South Wales and Vice-Admiral of the same. (From 23 February to 2 June the colony was administered by Sir Alfred Stephen.)
3 June 1872	19 March 1879	Robinson, Sir Hercules George Robert, G.C.M.G., afterwards Lord Rosmead. (From 20 March to 3 August the colony was administered by Sir Alfred Stephen.)
4 August 1879	9 November 1885	Loftus, Baron (Augustus William Frederick Spencer), P.C., G.C.B., Governor and Commander-in-Chief of New South Wales and its Dependencies. (From 10 November to 11 December the colony was administered by Sir Alfred Stephen.)

From	To	Name
12 December 1885	3 November 1890	Carrington, Baron (Charles Robert Wynn-Carrington), P.C., G.C.M.G. (From 3 November 1890 to 15 January 1891 the colony was administered by Sir Alfred Stephen.)
15 January 1891	2 March 1893	Jersey, Earl of (Victor Albert George Child Villiers), P.C., G.C.M.G. (From 3 March to 29 May the colony was administered by Sir F. M. Darley.)
29 May 1893	15 March 1895	Duff, Sir Robert William, P.C., G.C.M.G. (From 16 March to 22 November the colony was administered by Sir F. M. Darley.)
22 November 1895	5 March 1899	Hampden, Viscount (Henry Robert Brand), G.C.M.G. (From 5 March to 18 May the colony was administered by Sir F. M. Darley.)
18 May 1899	31 December 1900	Beauchamp, Earl (William Lygon).
1 January 1901	30 April 1901	Beauchamp, Earl (William Lygon), Governor in and over the State of New South Wales and its Dependencies. (From 1 November 1900, when Lord Beauchamp left New South Wales, until 27 May 1902, when Sir H. Rawson arrived, it was administered by Sir F. M. Darley.)
12 February 1902	24 March 1909	Rawson, Admiral Sir Harry Holdsworth, K.C.B. (From 24 March to 27 May the State was administered by the acting chief justice, George Bowen Simpson.)
28 May 1909	11 March 1913	Chelmsford, Baron (Frederic John Napier Thesiger), G.C.M.G. (From 11 to 14 March the State was administered by Sir W. P. Cullen.)
14 March 1913	27 October 1917	Strickland, Sir Gerald, Count della Catena, K.C.M.G. (From 28 October 1917 to 17 February 1918 the State was administered by Sir W. P. Cullen.)
18 February 1918	16 September 1923	Davidson, Sir Walter Edward, K.C.M.G. (From 16 September 1923 to 27 February 1924 the State was administered by Sir W. P. Cullen.)
28 February 1924		De Chair, Admiral Sir Dudley Rawson Stratford, K.C.B., M.V.O.

Victoria

30 September 1839	15 July 1851	La Trobe, Charles Joseph, Superintendent of District of Port Phillip.
15 July 1851	5 May 1854	La Trobe, Charles Joseph, Lieutenant-governor. (From 6 May to 22 June the colony was administered by J. V. F. Foster.)
22 June 1854	2 May 1855	Hotham, Sir Charles, Captain R.N., K.C.B., Lieutenant-governor of Victoria.
2 May 1855	31 December 1855	Hotham, Sir Charles, K.C.B., Captain-General, Governor-in-Chief of the Colony of Victoria; also Vice-Admiral, Commissary and Deputy in the Office of Vice-Admiralty, in the said Colony. (From 1 January to 26 December 1856 the colony was administered by Major-General E. Macarthur.)
26 December 1856	10 September 1863	Barkly, Sir Henry, K.C.B., Captain-General, Governor-in-Chief and Vice-Admiral.
11 September 1863	7 May 1866	Darling, Sir Charles Henry, K.C.B., Governor and Commander-in-Chief. (From 7 May to 15 August the colony was administered by Brigadier-General G. J. Carey.)

From	To	Name
15 August 1866	2 March 1873	Manners-Sutton, Sir John Henry Thomas, K.C.B., who became Viscount Canterbury in December 1869. (From 3 to 19 March the colony was administered by Sir W. F. Stawell.)
31 March 1873	22 February 1879	Bowen, Sir George Ferguson, G.C.M.G., Governor, Commander-in-Chief and Vice-Admiral.
27 February 1879	18 April 1884	Normanby, Marquess of (George Augustus Constantine Phipps), P.C., G.C.M.G. (From 18 April to 15 July the colony was administered by Sir W. F. Stawell.)
15 July 1884	8 March 1889	Loch, Sir Henry Brougham, G.C.M.G., K.C.B. (From 9 March to 17 October the colony was administered by Sir William Cleaver Francis Robinson, G.C.M.G.)
18 October 1889	15 November 1889	Loch, Sir Henry Brougham, G.C.M.G., K.C.B. (From 16 to 27 November the colony was administered by Sir W. C. F. Robinson.)
28 November 1889	12 July 1895	Hopetoun, Earl of (John Adrian Louis Hope), G.C.M.G., afterwards Marquess of Linlithgow. (From 27 March to 24 October the colony was administered by Chief Justice John Madden.)
25 October 1895	31 March 1900	Brassey, Baron (Thomas Brassey), K.C.B. (From 15 January 1900 to 10 December 1901 the colony was administered by Sir John Madden.)
10 December 1901	24 November 1903	Clarke, Colonel Sir George Sydenham, K.C.M.G., F.R.S., Governor in and over the State of Victoria. (From 24 November 1903 to 25 April 1904 the State was administered by Sir John Madden.)
25 April 1904	6 July 1908	Talbot, Major-General Sir Reginald Arthur James, K.C.B. (From 6 to 27 July the State was administered by Sir John Madden.)
27 July 1908	19 May 1911	Carmichael, Sir Thomas David Gibson, Baronet, K.C.M.G. (From 19 to 24 May the State was administered by Sir John Madden.)
24 May 1911	31 January 1914	Fuller, Sir John Michael Fleetwood, Baronet. (From 28 August 1913 to 23 February 1914 the State was administered by Sir John Madden.)
23 February 1914	31 January 1920	Stanley, Sir Arthur Lyulph, K.C.M.G. (From 30 July 1919 to 24 February 1921 the State was administed by Sir W. Irvine.
24 February 1921		Stradbroke, Earl of (Colonel George Edward John Mowbray Rous), K.C.M.G., C.B., C.V.O., C.B.E.
	South Australia	
28 December 1836	16 July 1838	Hindmarsh, Captain John, R.N., K.H., Governor and Commander-in-Chief of the Province of South Australia. (From 16 July to 17 October the colony was administered by George Milner Stephen.)
17 October 1838	15 May 1841	Gawler, Lieutenant-colonel George, K.H., Resident Commissioner.
15 May 1841	25 October 1845	Grey, Captain George, Governor and Commander-in-Chief of the Province of South Australia.
25 October 1845	2 August 1848	Robe, Lieutenant-colonel Frederick Holt, Lieutenant-governor of the Province of South Australia.
2 August 1848	20 December 1854	Young, Sir Henry Edward Fox, Kt.Bach. (From 20 December 1854 to 8 June 1855 the colony was administered by Boyle Travers Finniss.)

From	To	Name
8 June 1855	4 March 1862	MacDonnell, Sir Richard Graves, Kt.Bach., C.B., Captain-General and Governor-in-Chief of the Province of South Australia, and Vice-Admiral of the same.
4 March 1862	19 February 1868	Daly, Sir Dominick, Kt.Bach. (From 20 February 1868 to 15 February 1869 the colony was administered by Lieutenant-colonel Francis Gilbert Hamley.)
16 February 1869	18 April 1873	Fergusson, Sir James, Baronet, Governor in and over the Province of South Australia and the Dependencies thereof. (From 7 December 1872 to 8 June 1873 the colony was administered by Sir Richard Davies Hanson.)
9 June 1873	29 January 1877	Musgrave, Sir Anthony, K.C.M.G., Governor and Commander-in-Chief in and over the Colony of South Australia and its Dependencies. (The colony was administered by Chief Justice S. J. Way from 29 January to 24 March; by Sir W. W. Cairns from 24 March to 17 May; and by Chief Justice S. J. Way from 17 May to 2 October.)
2 October 1877	9 January 1883	Jervois, Sir William Francis Drummond, C.B., G.C.M.G., R.E. (From 9 January to 19 February the colony was administered by Chief Justice Way.)
19 February 1883	5 March 1889	Robinson, Sir William Cleaver Francis, K.C.M.G. (From 6 March to 11 April the colony was administered by Chief Justice Way.)
11 April 1889	10 April 1895	Kintore, Earl of (Algernon Hawkins Thomond), G.C.M.G. (From 17 January to 29 October the colony was administered by Chief Justice Way.)
29 October 1895	29 March 1899	Buxton, Sir Thomas Fowell, Baronet, G.C.M.G. (From 30 September 1898 to 10 April 1899 the colony was administered by Chief Justice Way.)
10 April 1899	31 December 1900	Tennyson, Baron (Hallam Tennyson), K.C.M.G.
1 January 1901	17 July 1902	Tennyson, Baron (Hallam Tennyson), K.C.M.G., Governor in and over the State of South Australia and its Dependencies. (From 17 July 1902 to 1 July 1903 the State was administered by Sir S. J. Way.)
1 July 1903	31 December 1908	Le Hunte, Sir George Ruthven, K.C.M.G. (From 1 January to 29 March 1909 the State was administered by Sir S. J. Way.)
29 March 1909	20 February 1914	Bosanquet, Admiral Sir Day Hort, K.C.V.O., K.C.B. (From 20 February to 18 April the State was administered by Sir S. J. Way.)
18 April 1914	9 February 1920	Galway, Lieutenant-colonel Sir Henry Lionel, K.C.M.G. (From 10 February to 9 June the State was administered by Sir G. J. R. Murray.)
9 June 1920	30 May 1922	Weigall, Lieutenant-colonel Sir William Ernest George Archibald, K.C.M.G. (From 24 April to 4 December the State was administered by Sir G. J. R. Murray.)
4 December 1922		Bridges, Lieutenant-General Sir George Tom Molesworth, K.C.M.G., C.B., D.S.O.

QUEENSLAND

10 December 1859	4 January 1868	Bowen, Sir George Ferguson, K.C.M.G., Captain-General and Governor-in-Chief of the Colony and its Dependencies, and Vice-Admiral. (From 4 January to 14 August the colony was administered by Sir Maurice Charles O'Connell.)

From	To	Name
14 August 1868	2 January 1871	Blackall, Colonel Samuel Wensley, Governor and Commander-in-Chief of the Colony and its Dependencies. (From 2 January to 12 August the colony was administered by Sir Maurice Charles O'Connell.)
12 August 1871	12 November 1874	Normanby, Marquess of (George Augustus Constantine), P.C. (From 12 November 1874 to 23 January 1875 the colony was administered by Sir Maurice Charles O'Connell.)
23 January 1875	14 March 1877	Cairns, William Wellington, C.M.G. (From 14 March to 10 April the colony was administered by Sir Maurice Charles O'Connell, and from 11 April to 20 July by Sir Arthur Edward Kennedy.)
20 July 1877	2 May 1883	Kennedy, Sir Arthur Edward, G.C.M.G., C.B. (From 2 May to 6 November the colony was administered by Sir Arthur Hunter Palmer, K.C.M.G.)
6 November 1883	9 October 1888	Musgrave, Sir Anthony, G.C.M.G. (From 9 October 1888 to 1 May 1889 the colony was administered by Sir Arthur Hunter Palmer.)
1 May 1889	31 December 1895	Norman, General Sir Henry Wylie, G.C.B., G.C.M.G., C.I.E. (From 15 November 1895 to 9 April 1896 the colony was administered by Sir Arthur Hunter Palmer.)
9 April 1896	31 December 1900	Lamington, Baron (Charles Wallace Alexander Napier Cochrane-Baillie, K.C.M.G.
1 January 1901	19 December 1901	Lamington, Baron (Charles Wallace Alexander Napier Cochrane-Baillie), K.C.M.G., Governor in and over the State of Queensland and its Dependencies. (From 21 June 1901 to 24 March 1902 the State was administered by Sir Samuel Griffith.)
24 March 1902	10 October 1904	Chermside, Major-General Sir Herbert Charles, R.E., G.C.M.G., C.B. (From 10 October 1904 to 30 November 1905 the State was administered by Sir H. M. Nelson.)
30 November 1905	26 May 1909	Chelmsford, Baron (Frederic John Napier Thesiger), K.C.M.G. (From 27 May to 2 December the State was administered by Sir Arthur Morgan.)
2 December 1909	16 July 1914	MacGregor, Sir William, G.C.M.G., C.B. (From 16 July 1914 to 15 March 1915 the State was administered by Sir Arthur Morgan.)
15 March 1915	3 February 1920	Goold-Adams, Major Sir Hamilton John, G.C.M.G., C.B. (From 3 February to 3 December the State was administered by William Lennon.)
3 December 1920		Nathan, Lieutenant-colonel Sir Matthew, P.C., Ireland, G.C.M.G.
	Western Australia	
1 June 1829	19 September 1834	Stirling, Captain James, R.N., Lieutenant-governor, Commander-in-Chief and Vice-Admiral.
19 September 1834	2 January 1839	Stirling, Captain Sir James, R.N., Governor, Commander-in-Chief and Vice-Admiral.
3 January 1839	26 January 1846	Hutt, John.
27 January 1846	11 February 1847	Clarke, Lieutenant-colonel Andrew, K.H.
12 February 1847	11 August 1848	Irwin, Lieutenant-colonel Frederick Chidley, R.N.

From	To	Name
12 August 1848	22 July 1855	Fitzgerald, Captain Charles, R.N.
23 July 1855	17 February 1862	Kennedy, Arthur Edward, afterwards Sir. (From 17 to 27 February the colony was administered by Lieutenant-colonel John Bruce.)
28 February 1862	2 November 1868	Hampton, John Stephen. (From 2 November 1868 to 30 September 1869 the colony was administered by Lieutenant-colonel John Bruce.)
30 September 1869	10 December 1874	Weld, Frederick Aloysius, Governor and Commander-in-Chief of Western Australia and its Dependencies. (From 11 December 1874 to 11 January 1875 the colony was administered by Lieutenant-colonel E. D. Harvest.)
11 January 1875	6 September 1877	Robinson, Sir William Cleaver Francis, K.C.M.G. (From 7 September to 12 November the colony was administered by Lieutenant-colonel E. D. Harvest.)
12 November 1877	30 January 1878	Ord, Major-General Sir Harry St. George, R.E., K.C.M.G., C.B., Lieutenant-governor and Commander-in-Chief of Western Australia and its Dependencies.
30 January 1878	6 April 1880	Ord, Major-General Sir Harry St. George, R.E., K.C.M.G., C.B., Governor and Commander-in-Chief of Western Australia and its Dependencies. (From 6 to 10 April the colony was administered by Sir Henry Wrenfordsley.)
10 April 1880	17 February 1883	Robinson, Sir William Cleaver Francis, K.C.M.G. (From 17 February to 2 June the colony was administered by Sir Henry Wrenfordsley.)
2 June 1883	21 December 1889	Broome, Sir Frederick Napier, K.C.M.G. (From 21 December 1889 to 20 October 1890 the colony was administered by Sir Malcolm Fraser.)
20 October 1890	16 August 1895	Robinson, Sir William Cleaver Francis, K.C.M.G. (From 16 August to 23 December the colony was administered by Sir A. C. Onslow.)
23 December 1895	30 June 1900	Smith, Lieutenant-colonel Sir Gerard, K.C.M.G. (From 30 June 1900 to 5 March 1901 the colony was administered by Sir A. C. Onslow, and from 5 March to 1 May by the senior judge, Edward Albert Stone.)
1 May 1901	14 August 1902	Lawley, Captain Sir Arthur, K.C.M.G., Governor of the State of Western Australia and its Dependencies. (From 14 August 1902 to 24 March 1903 the State was administered by Sir E. A. Stone.)
24 March 1903	23 April 1909	Bedford, Admiral Sir Frederick George Denham, G.C.B. (From 23 April to 31 May the State was administered by Sir E. A. Stone.)
31 May 1909	4 March 1913	Strickland, Sir Gerald, Count della Catena, K.C.M.G. (From 4 to 17 March the State was administered by Sir E. A. Stone.)
17 March 1913	27 February 1917	Barron, Major-General Sir Harry, K.C.M.G., C.V.O. (From 27 February to 9 April the State was administered by Sir E. A. Stone.)
9 April 1917	21 January 1920	Macartney, Sir William Grey Ellison, P.C., K.C.M.G. (From 21 January to 16 February the State was administered by Sir. E. A. Stone.)
16 February 1920	17 June 1924	Newdegate, Sir Francis Alexander Newdigate, K.C.M.G. (From 18 June to 27 October the State was administered by Sir Robert McMillan.)
28 October 1924		Campion, Colonel Sir William Robert, K.C.M.G., D.S.O.

TASMANIA

FROM	TO	NAME
16 February 1804	24 March 1810	COLLINS, Colonel David, Lieutenant-governor. (From 24 March 1810 to February 1812 the colony was administered by Lieutenant Edward Lord and Captain Murray, as commandants, and from February 1812 to 4 February 1813 by Lieutenant-colonel Geiles, as commandant.)
4 February 1813	9 April 1817	DAVEY, Colonel Thomas.
9 April 1817	14 May 1824	SORELL, Colonel William.
14 May 1824	30 October 1836	ARTHUR, Colonel George. (From 31 October 1836 to 5 January 1837 the colony was administered by Lieutenant-colonel Kenneth Snodgrass.)
6 January 1837	21 August 1843	FRANKLIN, Sir John, R.N., Kt. Bach., K.C.H.
21 August 1843	13 October 1846	EARDLEY-WILMOT, Sir John Eardley, Baronet. (From 13 October 1846 to 25 January 1847 the colony was administered by Charles Joseph La Trobe.)
26 January 1847	8 January 1855	DENISON, Sir William Thomas, Kt. Bach.
8 January 1855	10 December 1861	YOUNG, Sir Henry Edward Fox, Kt. Bach., C.B., Governor-in-Chief. (From 11 December 1861 to 16 June 1862 the colony was administered by Colonel Thomas Gore Browne, C.B.)
16 June 1862	30 December 1868	BROWNE, Colonel Thomas Gore, C.B. (From 30 December 1868 to 15 January 1869 the colony was administered by Lieutenant-colonel W. C. Trevor.)
15 January 1869	28 November 1874	DU CANE, Charles, Governor and Commander-in-Chief. (From 30 November 1874 to 13 January 1875 the colony was administered by Sir Francis Smith.)
13 January 1875	5 April 1880	WELD, Frederick Aloysius, C.M.G. (From 6 April to 21 October the colony was administered by Sir Francis Smith; and from 21 October 1880 to 6 December 1881 by Sir John Henry Lefroy, K.C.M.G., C.B.)
7 December 1881	28 October 1886	STRAHAN, Major Sir George Cumine, K.C.M.G., Governor and Commander-in-Chief. (From 29 October to 18 November 1886 the colony was administered by Chief Justice W. R. Giblin; and from 18 November 1886 to 11 March 1887 by Sir W. L. Dobson.)
11 March 1887	31 March 1893	HAMILTON, Sir Robert George Crookshank, K.C.B., Governor and Commander-in-Chief of Tasmania and its Dependencies. (From 30 November 1892 to 8 August 1893 the colony was administered by Sir W. L. Dobson.)
8 August 1893	13 October 1900	GORMANSTON, Viscount, Jenico William Joseph, K.C.M.G., Governor and Commander-in-Chief. (From 14 August 1900 to 8 November 1901 the colony was administered by Chief Justice J. S. Dodds.)
23 May 1901	16 July 1904	HAVELOCK, Captain Sir Arthur Elibank, G.C.M.G., G.C.I.E., Governor in and over the State of Tasmania and its Dependencies. (From 16 April, when Sir A. E. Havelock left the State, until 28 October, when Sir G. Strickland arrived, it was administered by Sir John Stokell Dodds.)
23 July 1904	21 May 1909	STRICKLAND, Sir Gerald, K.C.M.G. (From 21 May to 29 September the State was administered by Sir J. S. Dodds.)
29 September 1909	10 March 1913	BARRON, Major-General Sir Harry, K.C.M.G., C.V.O. (From 10 March to 4 June the State was administered by Sir. J. S. Dodds.)

From	To	Name
4 June 1913	31 March 1917	Macartney, Sir William Grey Ellison, P.C., K.C.M.G. (From 31 March to 6 July the State was administered by Sir Herbert Nicholls.)
6 July 1917	9 February 1920	Newdegate, Sir Francis Alexander Newdigate, K.C.M.G. (From 9 February to 16 April the State was administered by Sir Herbert Nicholls.)
16 April 1920	27 January 1922	Allardyce, Sir William Lamond, K.C.M.G. (From 28 January 1922 to 22 December 1924 the State was administered by Sir Herbert Nicholls, and during his illness by Mr. Justice Ewing.)
23 December 1924		O'Grady, Captain Sir James, K.C.M.G., O.B.E.

Goyder, George Woodroffe (1826-1898), born in Liverpool on 24 June 1826, in 1848 migrated to Australia; reaching Adelaide in 1851, he entered the public service, and in 1854 acted as deputy surveyor-general. In 1857 he penetrated the area north-east of Beltana, which was then believed to be saline and waterless, and found it timbered and traversed by deep creeks; Lake Blanche, which Sturt had found 'salt and brine,' was when Goyder reached it full of fresh water and apparently 30 miles or more long. Freeling, the surveyor-general, following his tracks six months later, could find no fresh water at all and was pessimistic about the possibility of expansion in that direction; but the view of his official heads may be judged by the fact that in January 1858 Goyder was definitely made deputy surveyor-general, and in 1860 succeeded Freeling as head of the department. From that time on he did little exploring work, though he actively supported every attempt to extend the knowledge of South Australian territory. His most important expedition was undertaken in 1868-9, when he was sent to the Northern Territory to survey areas for intending leaseholders. The officials previously sent there had attempted to locate a site for the chief settlement either on the estuary of the Adelaide or on that of the Victoria: Goyder, anchoring in Port Darwin on 5 February 1869, soon discovered a suitable site, and by the end of August had laid out the township of Palmerston and (in spite of bitter resistance from the aborigines, whom he vainly tried to conciliate) had surveyed about 700,000 acres for farming land. The other measure with which his name is closely connected is the first delineation of a boundary for wheat-growing, based on an average 14-inch rainfall. This line, known as 'Goyder's,' runs from a little north of Pinnaroo in a curve past Eudunda and Kooringa to Terowie, then between Yongala and Petersburg, then north-west to Mount Remarkable and south to Moonta; it has been of late years extended by improved methods of dry-farming, but on the whole is still substantially correct, wheat being profitably grown between it and the sea but not to any great extent beyond it. In 1880 Goyder was sent by the government to England to procure machinery for putting down deep bores in search of water, a scheme which he had for many years strenuously advocated. He left the service in December 1893, and in 1898 died at Aldgate in South Australia. (C.M.G., 1889.)

Grainger, Percy Aldridge, born at Brighton near Melbourne on 8 July 1882 and trained for a musical career by Louis Pabst in Melbourne, James Kwast in Frankfort, and Busoni in Berlin, gave concerts in Australia at the age of 12 and in Berlin and London at 17, and then toured Australasia with Ada Crossley (1903), Scandinavia with Herman Sandby (1904), and Britain with Adelina Patti (1905). In 1906-7 he visited Grieg in Norway and, becoming an intimate friend, has since been one of the Norwegian composer's best interpreters. From 1912 onwards he devoted himself to composition, employing folk-songs of various nationalities with great skill. Since 1915 he has lived mainly in the United States.

Grant, James (1772?-1833), was at the end of 1799—being at that time a lieutenant in the navy—appointed by the admiralty to command the *Lady Nelson* on her voyage to Australia. His choice was due partly to the recommendation of Sir Joseph Banks, partly to the fact that he was a close friend of Captain Schanck, who had designed the vessel with three centre-boards specially for survey work in shallow waters; under Grant, it was thought, the experiment would have a fair trial. The admiralty, knowing that Grant was no surveyor, had intended that on his arrival in Port Jackson he should be transferred to the *Supply*, and (probably) that Flinders should take over the survey work; but when he did arrive (on 16 December 1800) the *Supply* had been condemned as unfit for sea, Flinders was gone, and King had no one fit to conduct the coastal explorations for which the *Lady Nelson* had been sent out. He therefore offered Grant a continuance of his command, particularly praising his skill and perseverance in bringing the *Lady Nelson* through Bass Strait. An account of the subsequent explorations (December 1800 to July 1801) will be found under Exploration by Sea. To supply Grant's deficiencies as a surveyor Francis Barrallier (q.v.) was sent with him; but the arrangement was not comfortable for the naval officer, and on 31 August 1801 he straightforwardly admitted his incapacity for the work and asked leave to return to Europe, 'where I may be enabled to render myself more serviceable to my country.' King with equal straightforwardness, when granting the leave, regretted its cause; 'I should have been glad,' he wrote, 'if your ability as a surveyor . . . . was any ways equal to your ability as an Officer and a Seaman.' Leaving Port Jackson on 9 November 1801, Grant made his way to England—losing on the way some important despatches entrusted to him by King—served in

the North Sea, was made commander on 12 January 1805 for gallantry in action while in command of the *Hawke* cutter, and was granted a pension of £150 in 1806 on account of wounds received in action, but continued in the service and in later years commanded the sloops *Raven* and *Thracian*. He died at St. Servan (near St. Malo in France) on 11 November 1833. In 1803 he published a *Narrative* of the explorations of 1800-01, with a note on the origin and advantages of centre-boards.

Grant, JAMES MACPHERSON (1822-1885), born at Alvie in Scotland in 1822 and educated at Kingdenie, was in 1836 brought by his parents to Sydney and articled to a firm of solicitors. In 1844 he visited New Zealand and as a volunteer saw something of the war against Hone Heke. On his return to Sydney he was admitted a solicitor and practised for three years, then visiting San Francisco for his health's sake; he came back to try his luck on the Victorian goldfields, did well, and in 1854 commenced practice in Melbourne, becoming prominent by his successful defence (without fee) of the Eureka Stockade rioters early in 1855. This brought him into politics, and in November of that year the miners of Bendigo returned him as their representative to the council, sending him back in 1856 to the new assembly. In 1859 he was returned for Avoca, and retained that seat till 1883. On 20 February 1861 he began a ministerial career that lasted (with the natural interludes of life in opposition) for more than 20 years: he was commissioner of works in the Heales ministry (1861), commissioner of railways and afterwards president of the board of lands and works in two McCulloch ministries (1863-8 and 1868-9), president of the same board in the Duffy ministry (1871-2), minister of justice in two Berry ministries (1875 and 1877-80), and chief secretary and minister of public instruction in the O'Loghlen ministry of 1881-3. He was, that is, a politician of importance, for whom a post must be found in any ministry formed from his party. But his real interests were centred on land legislation; anxious to settle people on the land, he helped Heales to strain the 'occupation license' clauses of the Nicholson land act so as to place nearly 2000 persons on land which they could not otherwise have obtained for cultivation, and in 1865 passed an act—based on the principle that *bona fide* settlement should precede alienation—which increased settlement by 3½ million acres. An amending bill devised by him in 1868 was adopted by the ministry that succeeded McCulloch's, and became the land act of 1869, under which nearly 11 million acres were settled in nine years. The actually cultivated area grew under these two acts from 470,000 to 1,400,000 acres. He died at Melbourne on 1 April 1885.

Grass-bird. See WARBLERS.

Grasses. This article deals with (*a*) grasses native to Australia, (*b*) introduced grasses.

A. The *native grasses,* of which there is a great variety, possess remarkable nutritive and (in many cases) drought-resisting qualities. In the wheat-growing districts they have been largely displaced by introduced grasses, but in the pastoral areas excellent results have been obtained from them by judicious stocking. The germination of certain kinds (e.g. *Panicum* and *Andropogon*) has been proved to be very high. The chief dangers that threaten them are rabbits, overstocking—which tends to exterminate the better grasses and allow only the inferior to survive—and the lack of a proper subdivision of paddocks, whereby the grass is persistently eaten down and given no chance to shed its ripened seed.

There are over 200 species of native grasses, many of which have little economic value. The following are among the most important:—*Agropyrum scabrum* (Wheat-grass) has a wide range in pastures, and provides good feed in the early spring. *Agrostis* (a genus including the Bent and Snow grasses) occurs on the southern Alps, and is particularly valuable for sheep. Of the blue grasses (*Andropogon*) the most important is *A. sericeus* (Queensland Blue grass), found through the greater part of Queensland and the north-west of New South Wales; it is an excellent grass for fattening, and has palatable qualities. *A. intermedius* (Rare Blue grass) and *A. affinis* are common in New England; both respond well to cultivation. *A. bombycinus* and *A. erianthoides* are found in the far western districts of New South Wales and Queensland, and are strongly drought-resistant. Of the kangaroo-grasses (*Anthistiria* or *Themeda*) the most important are *A. ciliata* (*T. Forskallii*), the common Kangaroo-grass, and *A. avenacea*, the Wild-oat grass. Kangaroo-grass formerly occupied a wide area throughout the greater part of Australia, but soon succumbed to heavy grazing, and is now only found in abundance in protected areas. It is a valuable cattle-grass. Wild-oat grass is still fairly plentiful on plain country in New South Wales and Queensland, and is even better for cattle than kangaroo-grass.

Wire-grasses, also called three-awned spear-grasses (*Aristida*), are common in every State except Queensland, and are found chiefly on poor country. All except *A. Behriana* are very harsh, and little eaten by stock. The famous Mitchell grasses—*Astrebla elymoides* (Hoop Mitchell), *A. pectinata* (Curly Mitchell), and *A. triticoides* (Bull Mitchell)—have fattened more stock in Queensland than any other grass. They are highly nutritive, very quick-growing, and palatable even to maturity. They seem, however, to thrive only in the warmer northern parts of Australia. *Cenchrus tribuloides* (Burr-grass) is a rather coarse grass which produces good feed for stock in partly cleared scrub-lands in eastern Australia.

Of the star or windmill grasses the most important are *Chloris acicularis* (Umbrella-grass) found in the interior of Queensland, New South Wales, South Australia, and Western Australia; *C. barbata,* confined to Queensland and central Australia (sometimes called Australian Rhodes grass); *C. divaricata,* found in Queensland, New South Wales, and the Northern Territory; *C. truncata,* found throughout Australia; and *C. ventricosa* (Tall Star-grass) found in Queensland and New South Wales. All are valuable sheep-grasses, commencing growth in early spring and lasting well into the autumn.

Cynodon dactylon (Couch, Bermuda-grass, Doub-grass) is perhaps the most cosmopolitan grass in the world, as common in Australia as in India or America. It follows the plough everywhere, and forms a great carpet on river-flats in the warm months of the year. All stock eat it greedily, and fatten on it. *C. incompletus* (Blue Couch) is very like ordinary couch-grass, but is poisonous; fortunately it is not abundant (see NOXIOUS PLANTS).

The wallaby, white-top, or fluffy-top grasses (*Danthonia*) are the most persistent of all our

native grasses, abundant in every State except Queensland. In the wheat-growing districts they flourish on hill-sides, and are particularly valuable for sheep. They are the best winter native grasses Australia possesses, the largest and best species being *D. semiannularis, D. pilosa, D. varia, D. seminuda, D. Duttoniana,* and *D. caespitosa.*

Plume-grasses (*Dichelachne*) are common on the coasts and tablelands, but are not particularly valuable for pasture. Of *Diplachne* the commonest species is *D. loliiformis,* abundant on the black soils in Queensland and New South Wales; all the species are very palatable. A splendid cattle-grass of the genus *Ehrharta* occurs in Western Australia, but was probably introduced from South Africa.

The principal species of *Eleusine* are *E. aegyptiaca* (Button-grass) and *E. indica* (Crowfoot-grass). Button-grass is common in New South Wales, Queensland, and central and northern Australia. It grows quickly after summer thunderstorms, and is a good palatable grass for sheep. The less valuable crowfoot-grass is common in eastern Australia.

Of *Eragrostis* there are two groups—the wide-leaved species, commonly called love-grasses, of the coast and tablelands, and the usually narrow-leaved drought-resistant species of the interior, sometimes called never-fail or everlasting grasses. The latter are often provided with root-sheathing cases of sand, and with a dense coating of hairs at the base of the stem to prevent rapid evaporation. All are valuable sheep and cattle grasses, mostly confined to Queensland, New South Wales, and Victoria. *E. leptostachya* (Paddock Love-grass) and *E. Brownii* (Brown's Love-grass) are valuable for dairying.

Eriachne contains mostly northern Australian grasses, valuable for big stock. *Eriochloa* contains early spring grasses, palatable and nutritious, which are fairly common in New South Wales, Queensland, and the Northern Territory, and do remarkably well under irrigation. The water-grasses (*Glyceria*) are good cattle-grasses, found in marshy situations of the interior. *Hemarthria compressa* is a common coastal grass, found in sheltered situations throughout Australia; it is of little grazing value.

Imperata arundinacea (Blady grass) is widely spread in the southern hemisphere. It occurs abundantly after bush fires in the coastal districts, is very harsh, and is said to be good material for making paper. The species of *Isachne* are palatable, but not very abundant; they occur in the eastern States. *Iseilema (Anthistiria) membranacea* (Flinders, Barcoo, or Landsborough grass) is one of the most valued grasses in Queensland and northern New South Wales, and in popularity ranks next to the Mitchell grasses, with which it is often associated.

Of the mulga-grasses (*Neurachne*) the two most important are *N. alopecuroides,* found from New South Wales to Western Australia, and *N. Mitchelliana,* found in western New South Wales and Queensland. The latter is a good summer grass, frequently seen in mulga country. *Oplismenus compositus* is a trailing grass, found in moist situations in eastern Australia. *Oryza sativa* (Rice) is now growing wild in the Northern Territory, and may do great things under cultivation.

The genus *Panicum* provides a number of vigorous summer grasses of great value, with drought-resisting and nutritious qualities. The following are specially important. *P. decompositum* (Native Millet) and *P. prolutum* (Coolah-grass), found in all the States except Tasmania, are highly responsive to cultivation; the latter is a rapid grower under dry conditions, and will stand heavy grazing, though rather harsh when in flower. *P. flavidum* (Warrego Summer-grass) and *P. distachyum* are palatable grasses, widely distributed in the interior; the seed of the former germinates readily, and thrives under cultivation. *P. colonum* (Swamp or Barn-yard-grass) and *P. crusgalli,* a native of the eastern States, are closely allied to the Japanese millet; the former is sometimes a weed in other crops, the latter may be distinguished by its 'awned' flowers. *P. divaricatissimum* (Spider or Umbrella-grass) is spread over the interior of New South Wales and Queensland, where its seed-heads are commonly seen piled up against fences. There are two varieties, hairy and smooth, of which the former is strongly drought-resistant. Less palatable than some panic grasses, they provide good feed during the hot months. *P. leucophaeum* (Cotton Panic-grass) is short-lived, but grows quickly after thunderstorms in the interior of all the States. *P. trachyrachis* (Coolabah-grass) is common in the elevated parts of northern Australia. Less palatable species are *P. effusum* and *P. gracile,* found in all the States except Tasmania; the former, common in upland regions, bears a large seed-head which detracts from its grazing quality; the latter is a variable grass, of which the inland form is rather harsh. *P. marginatum* and *P. parviflorum* are eastern scrub-land grasses of little value.

The species of *Pappophorum* (sometimes called black-heads, from the colour of the inflorescence) are common in all the States except Tasmania, but are rather harsh and unpalatable. *Paspalum distichum* (Water Couch or Swamp Couch-grass) is a very valuable grass, found in moist situations in all States except Tasmania. It is credited with being one of our best fattening and milk-producing grasses. *P. scrobiculatum* (Ditch Millet), found in the eastern States in moist situations, is suspected of possessing poisonous properties. *Pennisetum compressum* (Squirrel-tail-grass) is found in the eastern States on the coast and tablelands, sometimes crowding out all other grasses. Unfortunately it is very harsh and quite unpalatable, as is *Poa caespitosa* (Australian Poa or Tussock Poa), common throughout Australia on the coast and tablelands, and strongly drought-resistant. It grows well during the cold months of the year. On black basaltic soils tussocks of this grass may be seen untouched by sheep, while all other vegetation is eaten out. The variety *latifolia,* limited in abundance, is eaten by large stock. *P. lepida* is a fairly palatable grass, occurring in the interior of New South Wales and South Australia.

Pollinia (Erianthus) fulva (Brown-top or Sugar-grass) is a valuable endemic, found in all the States except Victoria and Tasmania; most pastoralists speak highly of it as drought-resistant and nutritious. It also thrives under cultivation but the seed does not germinate well. *Setaria glauca* (Pigeon-grass), closely allied to the Hungarian and Manchurian millets, is found throughout Australia, particularly in moist situations. Being a short-lived summer grass, it is eaten readily in the young stages, but is likely to become troublesome in cultivated crops. *Sorghum (Andropogon) halepense* (Johnson grass) is possibly not indigenous, but is now well established throughout Aus-

tralia. Its underground creeping rhizomes possess remarkable vitality, and it is one of the worst pests in cultivated crops—see NOXIOUS PLANTS. Inland, where cultivation is little carried out, it can be strongly recommended as a pasture grass. *S. plumosum* (Wild Sorghum), found in all the States, especially in the highlands, is harsh and unpalatable. *Spinifex* is dealt with separately. *Sporobolus indicus* (Parramatta grass) is found throughout Australia, mostly in the coastal districts; it is a tough, wiry grass that has been known to loosen the teeth of horses grazing on it. It often takes possession of buffalo and couch lawns. Closely related to it is *S. diander*, which is more succulent. *S. Lindleyi* (Pretty Sporobolus) is a short-lived summer species, found in all the States except Tasmania, generally inland; it is succulent and palatable, with a handsome inflorescence. *S. virginicus* grows well in saline situations.

The *Stipa* (corkscrew or spear) grasses are amongst the commonest in Australia, being found in every State except, perhaps, the Northern Territory. Most abundant in the interior, they often form an association with *Danthonia* grasses, crowding out other vegetation. Most are useful, in spite of their harsh character, for their drought-resistant qualities and because they provide early spring feed. The ripe seeds are troublesome, penetrating the skin, eyes, and jaws of grazing stock. The most important species are *S. aristiglumis* (Plains grass) which grows in a good season to a height of six or seven feet, fattens cattle very quickly and is abundant in the north-west of New South Wales; *S. flavescens*, common in the southern States; and *S. pubescens*, *S. scabra*, and *S. setacea*, found in *Danthonia* pastures in all the States except Queensland.

Tragus (*Lappago*) *racemosus* (Burr-grass), found in the interior in all the States except Tasmania, is short-lived and common on cultivated lands. It is palatable and nutritious. *Triraphis mollis*, found occasionally but not abundantly in the interior of all the States, is a good grass for both large and small stock.

B. The coastal and plateau regions of Australia are particularly adapted to the growth of certain *exotic* grasses, many of which have greatly improved our sheep and cattle pastures. The following are the most important:—*Agrostis alba*, var. *stolonifera* (Creeping Bent grass) is useful for lawns and golf links, or as a constituent of pastures in cool, moist situations. The fox-tail grasses (*Alopecurus*) are fine-leaved grasses, sometimes included in mixtures for cold districts. *Andropogon sorghum*, var. *sudanensis* (Sudan grass) was introduced in 1913, and is now very much in favour amongst farmers in the wheat and dairying districts. It is strongly drought-resistant and nutritious, producing an enormous amount of fodder in summer and autumn. It can be grown for hay, silage, or as pasture. Cases of poisoning from this grass have recently been recorded, but, on investigation, it has been found that such poisoning was due to sorghum-Sudan grass hybrids, the result of sowing impure seed. *Avena elatior* (Tall Oat-grass), a succulent grass, grown largely in New Zealand, is a valuable constituent of winter pastures.

Bromus inermis (Awnless or Hungarian Brome grass) is a perennial grass of excellent nutritive value, which appears more adapted to the highlands than to the coast. *Bromus unioloides* (Prairie or Rescue grass) is one of our best winter grasses, and generally included in rye-grass-cocksfoot mixtures. Being an annual, however, it soon disappears under heavy stocking. A promising perennial strain is now being developed.

Chloris Gayana (Rhodes grass) is very popular in Queensland, but in eastern New South Wales is outclassed by *Paspalum dilatatum*. More drought-resistant and succulent than *Paspalum* in its young stages, it will not carry as many stock as the latter in an ordinary season. *Cynosurus cristatus* (Crested Dog's-tail) is a good winter grass, often used in mixtures in Victoria and Tasmania. *Dactylis glomerata* (Cocksfoot or Orchard-grass) is one of the oldest and most reliable of all introduced grasses, and is particularly adapted to cold localities. Owing to its tussocky habit, it is generally mixed with perennial rye-grass. *Eragrostis abyssinica* (Teff grass) is an annual, which takes the place of millet in Queensland and the warmer areas of other States.

Of the fescue grasses (*Festuca*) the coarsest and most drought-resistant is *Festuca arundinacea* (Giant Fescue), which is a good cattle-grass; Hooker's fescue is a form of this grass. The fine-leaved fescue grasses, *F. ovina* (Sheep's Fescue), *F. rubra* (Red Fescue), and *F. duriuscula* (Chewing's Fescue), are often used as constituents of pastures in dry situations. *Holcus lanatus* (Yorkshire Fog) has a low nutritive value, and can only be recommended for marshy areas and poor soils where other grasses will not grow. *Lolium italicum* (Italian Rye-grass) is most important for the cooler localities. It is often sown with a winter cereal crop, and provides a great amount of overmath which can be utilized for pasture; it also makes excellent hay. Westernwolth's rye-grass is a superior variety of Italian rye-grass. *L. perenne* (Perennial Rye-grass) is one of the most widely known of all introduced grasses. It revels in cool, moist situations, and a pasture mixture of cocksfoot, rye-grass, and red clover is probably an ideally balanced ration. Perennial rye-grass will not endure much hot, dry weather. *L. subulatum* (Wimmera Rye-grass) has lately come into favour as a good winter and spring grass in the wheat-growing districts of Victoria.

Melines minutiflora (Molasses-grass), a South American plant, promises good results in Queensland and on the northern rivers of New South Wales. It has a distinct 'sticky' feel, due to the presence of a large amount of mucilage.

Oryzopsis miliacea (Little Millet) is adapted to very dry situations, but is slow-growing, and hence not popular with farmers. *Panicum maximum* (Guinea grass) is a palatable, nutritive grass, suitable for warm, moist localities, as also is *P. muticum* (Para grass), which spreads vigorously from its creeping stems.

Paspalum compressum (Carpet grass) is well adapted to poorer soils in moist situations. It does not spread as rapidly as *P. dilatatum*, but is more palatable and nutritive. *P. dilatatum*, the commonest introduced grass in Australia, on which alone thousands of dairy stock are kept in eastern New South Wales, is discussed under PASPALUM. *Pennisetum clandestinum* (Kikuyu grass) is an African grass of recent introduction. In summer it overruns the ground at a very rapid rate, and is most promising for the warmer parts of Australia. *P. purpureum* (Elephant-grass or Napier's Fodder) is another African introduction, which in the warm months of the year produces up to 70 tons of grass-feed per acre, and is suitable for any

locality where frosts are not severe. *Phalaris bulbosa* (Toowoomba Canary-grass) is the best winter grass yet introduced into New South Wales. Succulent and palatable, it will stand a good deal of stocking, and can be strongly recommended for agricultural districts throughout Australia. *P. canariensis* (Canary-grass), an annual, is suited to the same localities. *P. minor* (Wild Canary-grass) is spreading through the wheat-growing districts of New South Wales and Victoria, and is often found in association with *Hordeum murinum* (Barley-grass), but is much more valuable. *Phleum pratense* (Timothy grass) is mostly grown for hay; it does fairly well in the elevated parts of New South Wales and Victoria.

Poa aquatica (Water-grass) is adapted to cold localities, and is propagated by roots which run vigorously through the soil. *P. compressa* (Canadian Blue grass), a fine-leaved grass, does well in parts of Victoria. *P. pratensis* (Kentucky Blue grass) is an excellent constituent of pastures in the colder districts. Slowly established, it is then most persistent, providing excellent feed for sheep. *Setaria nigrirostris* (South African Pigeon-grass) is a perennial form of pigeon-grass which produces a large amount of summer feed. Buffalo-grass (*Stenotaphrum glabrum*) is the favourite grass for lawns on the coast, and in localities where the winters are not too severe. Before the advent of *Paspalum* it was used largely on the northern rivers of New South Wales; owing to its coarseness, however, it has now been discarded for this purpose. *Tricholoena rosea* (Natal Red-top) does very well in Queensland, but is not considered very palatable. It has a handsome inflorescence.

In the wheat-growing districts of most States certain introduced plants have completely displaced the native grasses. In good seasons this herbage, if conserved as silage, would give a larger amount of fodder than the product of the original pastures—probably ten tons per acre. Amongst them are the following:—*Medicago lacinеata, M. maculata,* and *M. minima* (Burr Trefoils); *Erodium cicutarium* and *E. moschatum* (Crowfoot-grasses), which form rosettes in *Danthonia* and *Stipa* pastures; *Trifolium glomeratum* and *T. tomentosum,* nutritious clovers abundant in the Riverina and Victoria; *Malva parviflora* (Marsh Mallow); *Carduus marianus* (Variegated Thistle) and *C. pycnocephalus* (Slender Thistle); *Hordeum murinum* (Barley-grass), the commonest of all introduced herbage, the ripe seeds of which are troublesome to stock; *Festuca bromoides* (Rat's-tail Fescue); *Lamarckia aurea, Bromus maximus, B. mollis,* and *B. racemosus.* E.B.

Grasshoppers and Locusts, insects of the order Orthoptera, comprising two distinct groups (*a*) the long-horned grasshoppers or Tettigoniidae (Locustidae of some authors, by a time-honoured misconception) and (*b*) the short-horned grasshoppers or Acridiidae. The Tettigoniidae are very abundant, nearly 200 Australian species being known. The huge and fierce King Cricket (*Anostosoma australasiae*) lives in holes in the ground, and in many respects resembles the Gryllidae (see CRICKETS). Many handsome species live in the dry western districts of New South Wales and Queensland; Plate xix, fig. 3, shows the rare and remarkable Crested Grasshopper (*Alectoria superba*). A handsome speckled grasshopper (*Ephippitytha 32-guttata*) is rather common in coastal districts. The Mountain Grasshopper (*Acridopeza reticulata*), the female of which has peculiarly crinkled, half-developed wings, and the remarkable Cave Grasshoppers of the genus *Pachyrhamma,* with their excessively long antennae, are interesting members of our fauna.

Some of the species are troublesome to orchardists, but many are carnivorous. The winged males makes a curious noise, usually after sunset, by rubbing parts of the wings together, each species making its own characteristic sound. Each female is provided with an ovipositor, in some species short and curved, in others thin, straight, and long. A Western Australian species of *Metaballus* is an orchard pest, and eats large holes in ripening fruit. The ovipositor of the female is as long as the rest of the body.

The short-horned grasshoppers (Acridiidae) are the most highly specialized of the Saltatoria, and include the true plague-locusts. More than 350 Australian species of this family have been described; but more still remain to be described, especially among the peculiar pigmy locusts (Tettiginae), of which several species are found in the inland districts. Many handsome members of this family are familiar members of our insect fauna; plate xix, fig. 4, shows the inland species *Stropis maculosa.* Other well-known genera are *Goniaea, Coryphistes, Hyalopteryx, Monistria,* and the peculiar *Acrida.* In the last-named genus the head is pointed, and the thickened antennae are held straight out in continuation of it. *Coryphistes ruricola,* a large species of a mottled grey colour, rests on the bark of trees where it is not easily seen.

The name 'locust' is also popularly, but erroneously, applied to the cicadas (q.v.). R.J.T.

In Europe, Asia, and Africa from time immemorial locusts have appeared in overwhelming numbers, and have devoured every green thing over wide areas. In the United States and Africa, especially, concerted efforts are now made to destroy the mature insects on a wholesale scale, to map out their egg-laying districts, and to destroy the eggs and newly-hatched young. Although their visitations have been less disastrous in Australia, yet great loss of stock has followed their devastation of grass and fodder-plants, and much wheat has been destroyed. Breeding in the open plains, and having exhausted the food of their hatching-grounds, they assemble and take flight, seldom rising far from the ground, and in the course of a day's flight may settle many times; but not all together. As the ground is stripped bare, the numbers are increased by local swarms, till a flight may be many miles in width and depth. The flights are invariably followed by crows, hawks, magpies, wood-swallows, and other birds; emus, bustards, and ibises also feed largely upon the locust. The curious whirring noise heard during these flights is due in part to the wings, but largely to a stridulation caused by rubbing a criss-cross sculpture of the hind-leg. A few years back hopes were entertained of destroying locusts by a parasitic African fungus; this was tried in New South Wales, Victoria, and Tasmania, but without appreciable effect, probably through having to be used in hot, dry weather. A local fungoid disease, however, kills off many wingless grasshoppers in some forest districts of New South Wales; in country liable to floods the eggs are sometimes destroyed over large areas by mould.

In Australia, through the attacks of parasites,

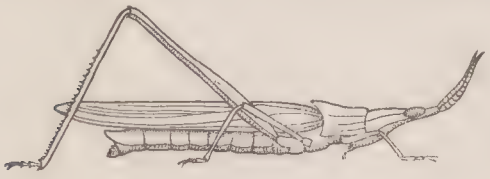
locusts are seldom seriously troublesome two years in succession. From an examination at Queanbeyan of thousands of the common plague-locust, the writer found that some 90 per cent of the females were being destroyed by the maggots of a fly (*Masicera* species), which, living in the abdomen of the locust, destroyed the eggs. Again, the eggs after being deposited in the ground are largely destroyed by chalcid and ichneumon wasps. In America the egg-masses are often destroyed by the larvae of blister-beetles (Cantharidae), but although many of these occur in Australia they have not yet been recorded as doing this useful work. Ants and other insects, too, kill many female locusts when drilling the holes in the ground in which they deposit their eggs. Heavy rollers and hopper-dozers (flat trays with a ridge at the back, drawn by horses) have been used to destroy locusts, and against comparatively small numbers arsenical sprays and poisoned baits may be used.

The Common Plague-locust (*Chortoicetes terminifera*, also known as *Pachytilis australis*) is probably the most destructive Australian species. It occurs in all the States, and in 1891 caused great loss of stock, as well as the destruction of orchards and vineyards in New South Wales, Victoria, and South Australia; waterholes, wells, and other depressions were filled by its numbers, and for two years traces of its visitation were visible. In 1917 and 1921 trains were delayed in Victoria and South Australia, the crushed locusts preventing the wheels from gripping the rails. There are several broods of this species in a season.

The Smaller Plague-locust (*C. pusilla*), with a less extensive range than the first-mentioned species, does a great deal of harm in Australia. Its habits are much the same as those of *C. terminifera*, but when egg-laying the female is usually attended by an irregular ring of males, with one or two in contact with her, head to head.

A very large locust (*Cyrtacanthacris exacta*), measuring up to six inches across the expanded wings, is sometimes troublesome to fruit-trees, tree-cotton and other cultivated plants in the mainland States, but does not appear to migrate in swarms. A still larger, but fortunately rare, species of this genus occurs in Queensland and northern New South Wales.

The Thin Locust (*Acrida turrita*), which has very long hind-legs and flattened antennae, is common in many parts of Australia. It varies in colour from a delicate green with pale stripes



Acrida turrita.

to an almost uniform pale brown. It does not congregate in masses, even when numerous, and makes a curious rattling noise during its short flight.

The Yellow Under-wing Locust (*Gastrimargus musicus*, more commonly known as *Locusta danica*), occurs in all the Australian States as well as in Europe and Asia. It attacks the sugar-cane in northern Queensland, and few cultivated plants escape its attentions. In the mating season flights may be continuous in the same direction for days, though each individual may fly only a few hundred yards before settling. It is a handsome green and brown insect, with a conspicuous patch of yellow, bordered with black, on each hind-wing; these are concealed except during flight. Many other Australian locusts are known. See ORTHOPTERA.

A.M.L.

Grass-trees. (1) This popular name is given in the eastern States to several species of the endemic genus *Xanthorrhoea* (family Liliaceae) which in South Australia (especially on Kangaroo Island) are known as 'yaccas' or 'yuccas,' and in Western Australia as 'blackboys.' There are 13 species, distributed as follows: New South Wales 5, South Australia 5, Queensland 4, Tasmania 3, Western Australia 2. They have a thick stem, which may form a short trunk, or may (as in *X. arborea*) reach a height of 10-12 feet. *X. Thorntoni* is found in the Macdonnell Ranges; *X. pumilio* is a pigmy form from Port Curtis. The long, rigid, grass-like leaves spring in a dense tuft from the crown of the trunk, and from their centre the elongated flower-stem rises to a height of 4-8

Xanthorrhoea hastilis.

feet. The flowers are packed round the apex of the stem in a dense cylindrical spike 1-2 feet long. Several species yield a balsamic resin known as 'grasstree gum,' which has been

tested for picric acid (to be used in the manufacture of explosives); but other more profitable sources of supply have been discovered. The gum is also used in the manufacture of varnish, and paper-pulp has been experimentally manufactured from the fibre. Industrial alcohol has been extracted from the trunk, which has been further investigated for its starch content. The chief source of supply of the resin is Kangaroo Island, whence it is still exported to the United States. The name 'black-boy' was suggested by the rounded trunks, which retain the charred remains of the leaf-bases for years after a bush fire, and with the flowering stem roughly resemble a blackfellow carrying a spear.

(2) The grass-tree of Western Australia is *Kingia australis*, which has the leaves and rounded trunk of *Xanthorrhoea*, but sends up several flexuous stems; the flowers are arranged in globular terminal heads, so that it becomes many-headed. It is known also as 'drum-head' or 'silver-leaf grass-tree.'

Grass-wren. See BRISTLE-BIRD.

Grayson, HENRY JOSEPH (1857-1918) was born at Worrall near Bradfield, in Yorkshire, but spent the last 30 years of his life in Melbourne. A gardener by trade, he interested himself in botany, and particularly in plant microscopy. The problem of testing high-power microscopes led him to construct a machine capable of ruling uniformly-spaced lines on a glass slip at distances down to 1/120,000 inch. These 'Grayson rulings' acquired almost immediately a world-wide reputation amongst microscopists. At a later time he designed and made for the geological department of the university of Melbourne a rock-slicing machine which is probably the most efficient in existence. His last mechanical triumph was a ruling-engine for making diffraction-gratings. Here he achieved a success in advance of that attained by the most accomplished experimentalists in America, backed by almost unlimited resources. This instrument, left, fortunately, in perfect condition at his death, is being used at the university of Melbourne for important researches in optics. He died on 21 March 1918.

W.A.O.

Grease-nut Tree. See LAURACEAE.

Crested Grebe.

Grebes, aquatic birds belonging to the family Podicipidae, found chiefly on lakes, swamps, and waterholes, but occasionally also on bays and inlets of the sea. They differ from all other aquatic birds, except coots, in having each toe provided with its own web. They are expert divers, and feed on small fish, aquatic insects, etc. Their nests are merely piles of floating water-weeds; when the birds leave them, they invariably cover up the eggs with weeds, so that the nest looks like a mere accumulation of vegetable material.

Three species occur in Australia. Two are small (up to 10 inches long), and are often called dabchicks; one of these, the Hoary-headed Grebe (*Podiceps poliocephalus*), is peculiar to Australia and Tasmania, the other, the Black-throated Grebe (*P. ruficollis*), is found throughout the old world. The large and handsome Crested Grebe (*P. cristatus*) has a similar distribution.

W.B.A.

Green Arum. See CUNJEVOI.

Greenie. See HONEY-EATERS and WHITE-EYES.

Greenway, FRANCIS HOWARD (1777-1837), was trained in London for the profession of architect, and afterwards practised in Bristol and Bath. According to his own claim, he was connected with 'some of the most extensive concerns in England, public, speculative and private' as well as with 'one of the ablest Improvers of Estates.' Lack of success, however, led him to bankruptcy—possibly he had already contracted what Bigge describes as 'habits of negligence and indulgence'—and for concealing his effects at the bankruptcy he was in 1812 sentenced to 14 years' transportation, and arrived in Port Jackson as a convict on 7 February 1814. At Bath he had gained the sympathy of Arthur Phillip, then near his deathbed; on Phillip's recommendation Macquarie granted him a ticket of leave, and in December he started practice as an architect and expert in the laying out of estates 'as well in the agricultural part as the beautifying.' He had already (27 July 1814) put before Macquarie proposals for a market-house and town-hall worthy of the city they both anticipated. In 1815 (by which time he was 'acting for the Government but not in office or receiving pay') he made proposals still more ambitious; one was for a lighthouse on North Head with a small fort and an auxiliary beacon on the Sow and Pigs reef, another for a large fort on Observatory Hill with an advanced redoubt on Dawes Point and a bridge thence to the northern shore of the harbour. Macquarie, however, found these schemes too magnificent even for his ardent imagination, and insisted that the lighthouse should be built on South Head (where it could easily be reached by land) and the main defence works constructed at the eastern point of Sydney Cove—then known as Bennelong Point, and since as Fort Macquarie; the bridge proposal he discarded altogether. In 1816 Greenway aided the governor to bring to book the contractors for the Sydney hospital buildings, who had scamped their foundations and otherwise failed to carry out their contract; he also pledged himself, if Macquarie would abolish the system of private contracts paid for with the privilege of importing spirits, to erect more and better buildings in four years than had been erected since the colony was founded. This ap-

pealed to the builder-governor, and Greenway was made civil architect and assistant to the inspector of public works. In this position he greatly improved in both style and soundness the buildings that were being erected in and around Sydney, and the best specimens of Macquarie's architecture—the Hyde Park barracks at the top of King-street (now the district court), St. James's church, St. Matthew's church at Windsor, government house in the inner domain (which he modelled on Thornbury Castle, 'only much bolder')—are undoubtedly his. He also devised, but was not allowed to construct, a conduit for the town's water-supply with a branch to Darling Harbour (then called Cockle Bay) for the use of visiting ships, a main drain, a 'Doric screen' connecting the barracks with what is now St. James's church but was at first intended for a court-house, and a systematic plan for the extension of the town—the first Australian town-planning proposal. On 16 December 1817, on which day the Macquarie lighthouse at South Head was completed and the foundation-stone of Fort Macquarie laid, Governor Macquarie celebrated the occasion by emancipating the architect. Earlier in the year he had reported Greenway's appointment to the colonial office, and in 1818 Bathurst confirmed it, but only as a temporary appointment; Macquarie in reply (24 March 1819) laid stress on Greenway's 'Scientific Skill, Judgment and superior Taste,' and asked leave to increase his pay from 3s. a day to 5s., 'Mr. Greenway being now Free and having a large family to support in the Line of Respectability to which they have been accustomed.' Bathurst's only comment was to suggest that, as the duties of civil engineer and civil architect 'appear to be nearly the same,' the offices might be amalgamated and performed by Greenway alone. In 1818 the undaunted architect brought up a proposal for a new church, to stand where the Sydney town-hall now stands, in the middle of a 'four-way circus' with roads to Parramatta, Dawes Point, Darling Harbour and Hyde Park, and digging for the foundations was begun in 1819; but at this stage J. T. Bigge (q.v.) arrived in Sydney and proceeded to attack Macquarie for showing too much hospitality and favour to emancipists, among whom was Greenway. He was forced to admit Greenway's talents as an architect—'as far as they were employed in the public buildings I have mentioned, the benefits derived from them have been very conspicuous'—but accused him of habits of negligence and indulgence, of a disposition to spend too much money on ornamentation (why, thought Bigge, should buildings for convict use be other than plain), and of quarrelling with Major Druitt, the chief engineer; and he recommended the appointment of an engineer officer from England, and the abolition of Greenway's office. He also stopped the work on the new church, and persuaded Macquarie to convert the King-street court-house into a church (St. James's), and build a little way off a school-house which might be used as a temporary court-house (this stood in Castlereagh-street, and was from 1884 until its demolition in 1922 used as a girls' high school).

It was probably this wholesale interference with his work and Macquarie's failure to support him that in 1821 irritated Greenway into a bitter quarrel with the governor, as a consequence of which Macquarie ceased to favour him; Brisbane, adopting Bigge's recommendation, made Major Ovens his chief engineer, and Greenway retired into private practice. The rest of his life is buried in obscurity; the attribution to him of the first designs for St. Mary's chapel (since become a cathedral) is very doubtful. In 1822 and 1825 he unsuccessfully memorialized Brisbane for a title to the house in which he had long lived, and which was claimed by the surveyor-general as government property, and in 1825 published in the *Australian* a series of letters giving an account of his previous work from which much of the foregoing information has been gathered. In 1829 he was refused a clean title to land in Argyle-street which had also been promised him (according to his own account) by Macquarie; but, since Macquarie and Greenway were equally out of favour, nothing less than documentary evidence was reckoned valid by the new officialdom. In 1831, and again in 1836, he claimed 'the original projection of the intended Circular Wharf in Macquarie Place:' in 1834 the *Sydney Gazette* published a long letter from him on the harbour defences: in January 1835 he advertised in the same newspaper that 'Francis Howard Greenway, Architect, Arising from circumstances of a singular nature, is induced again to solicit the patronage of his Friends and the Public.' In May 1837 he applied for registration of a block of land near Morpeth which Macquarie had in 1821 promised him in writing as compensation for work done before his formal appointment as civil architect, and this was granted in November. But before that date Greenway was dead. The exact date of his death is uncertain; all we know is that he was buried at Maitland on 25 September 1837 by the parish schoolmaster, the local chaplain being absent on leave. The land was afterwards granted to his son William. Another son, Charles Capel Greenway, was in 1882-94 archdeacon of Grafton in New South Wales.

Gregory, Sir Augustus Charles (1819-1905), born at Farnsfield in Nottinghamshire on 1 August 1819, was in 1829 brought to Western Australia by his father, who had received a grant of land in the Swan River settlement in lieu of pension when he retired wounded from military service. In 1841 young Gregory entered the colony's survey department, and from 1842 to 1854 was assistant surveyor. In 1846 he made the first of a number of explorations in the interior, which are enumerated and briefly described under Exploration by Land; in their course he discovered coal on the Irwin River and galena on the Murchison. In 1855-6 he headed one of the expeditions sent out to discover traces of the lost explorer Leichhardt (q.v.), and opened up the Victoria River to its source, thence traversing the Northern Territory to Burketown in northern Queensland, and reaching Brisbane via the Gilbert, Burdekin, Fitzroy and Burnett; for this achievement he was awarded the founder's medal of the Royal Geographical Society. In 1858 he made a second attempt to trace Leichhardt, on this occasion travelling through central Australia via the Warrego and Barcoo (which he discovered to be identical with Cooper's Creek) past Lake Torrens to Adelaide. He was then employed to mark the southern boundary of the new colony of Queensland, and on 23 December 1859 was made surveyor-general of that colony.

This ended his exploring period, as for the next 20 years he was occupied with departmental and geological investigations. On 10

November 1882 he was nominated to the legislative council, where almost until his death he did valuable non-partisan work. He was also a trustee of the Queensland museum (1876-99), a member of the aborigines commission (1876-83), and in 1895 president of the Australian Association for the Advancement of Science. It is, however, chiefly for his explorations that he is remembered: he is said to have 'contributed more to the exact physical, geological and geographical knowledge of Australia than any other man,' since his journeys opened up hitherto unknown regions in the four larger colonies and extended east and west the whole length of the continent. He died in Brisbane on 25 June 1905. (C.M.G., 1875; K.C.M.G., 1903.)

A brother, FRANCIS THOMAS GREGORY (1821-1888), also employed in the survey office at Perth, accompanied him on several journeys in Western Australia, in 1858 explored the Murchison-Gascoyne region independently and in 1861 opened up the valleys of several rivers on the north-western coast from the Ashburton to the De Grey. In 1863 he was awarded the gold medal of the Royal Geographical Society. Leaving Western Australia for Queensland in 1862, he was in 1874 nominated to the council, where he took a more actively partisan part than his brother; in 1883 he was for a few weeks postmaster-general in the McIlwraith ministry, and in 1886 led the council's opposition to payment of members. He died at Toowoomba on 24 October 1888. The two brothers in 1884 published at Brisbane their *Journals of Australian Explorations.*

Gregory, SYDNEY EDWARD, born at Sydney on 14 April 1870, played in first-class cricket from 1889 to 1912, and was a member of every Australian team that visited England during those years; he took part also in every test match played in Australia between March 1892 and February 1904, and in those played in February 1908 and February 1912. First taken to England principally for his fielding—he was a great cover-point—he soon developed a great variety of strokes as a batsman; thus in 1890 his average score in test matches was 5, in 1894-5 it was 40. He captained the team that went to England in 1912. In test cricket he has played 92 innings (Hill played 76 and Trumper 74), scoring 2193 runs in all, with an average of 25.8; he has made four centuries, his best being 201 at Sydney in December 1894.—His nephew JOHN MORRISON GREGORY, born at Sydney on 14 August 1895, came into prominence as a member of the A.I.F. team which toured England, South Africa and Australia after the war, making his mark as a fast (right-hand) bowler, a left-hand batsman, and a fieldsman; he is probably the best slip-fieldsman in modern cricket. His career in test cricket began in 1920; in the 1920-1 season he was third in both bowling (24.17) and batting (73.66) averages. Up to the end of the 1923-4 season his test averages were:—batting, 47.33, bowling, 26.38. See CRICKET.

Gregson, THOMAS GEORGE (1791-1874), born at Durham, England, in 1791, migrated to Tasmania in 1821 and embarked on a pastoral life. In 1827 he was active in endeavours to get for the colony liberty of the press, trial by jury, and a representative legislature. He was the leader of the 'patriotic six' who in 1845 resigned from the council as a protest against the doings of Governor Eardley-Wilmot (q.v.). Richmond elected him to the council in 1850, and to the first assembly under responsible government in 1856; carrying a vote against the Champ ministry, he formed a ministry himself in February 1857, but was defeated two months later. He remained an active politician, sitting for the same constituency, till his death on 4 January 1874. During the forties he won local renown as an artist.

Grevillea, a large genus of the family Proteaceae, consisting of shrubs or trees with alternate leaves. It comprises 193 species, a few of which occur in New Caledonia, while all the rest are endemic in Australia; in size, form and structure these show more variation from normal family type than is usual even among Proteaceae. The corolla-lobes are usually revolute; anthers not stalked, seated on corolla-segments; style protruding from a slit in the corolla-tube before the flower opens; fruit a leathery follicle opening along the upper margins. The genus is divided into numerous sections, resting chiefly upon variable floral characters. Of two larger groups one comprises species with a more or less orbicular cluster of flowers, radiating from the top of a common stalk—as in the grey, red, and white or pink 'spider flowers' of the eastern coastal sandstone; the other has a flattened spike-like inflorescence, with the flowers all turned to one side of the axis—as typified in the Silky Oak (*G. robusta*), q.v. *G. striata* (Western Beefwood)—the fresh timber resembles raw beef—has long spikes of creamy yellow flowers. Its leaves are sparingly eaten by stock, and its timber is adapted for ornamental cabinet work. *G. Hilliana* (White Yiel Yiel) has a timber suitable for veneers. The pendulous *G. asplenifolia* is a graceful shrub with a silvery sheen on the under-side of its prettily cut leaves. It is easily r ised, being very adaptable to soil, climate, and pruning operations. A rare species, *G. Gaudichaudi,* is probably a natural hybrid between the swamp-loving *G. acanthifolia* and the carpet-forming *G. laurifolia* of the sandstone hillsides. All three are found in juxtaposition on the higher elevations of the Blue Mountains. *G. Banksii,* a handsome species with bright ruby-coloured flowers, and a cream-coloured variety of this species, have long been in cultivation.

Grey, SIR GEORGE (1812-1898), born at Lisbon on 12 April 1812 a few days after his father, Lieutenant-colonel Grey, had fallen at Badajos, was educated at Sandhurst and joined the army in 1829 (ensign, 1829; lieutenant, 1833; captain, 1839). After a short term of service in Glasgow he was ordered to Ireland, then disturbed, and while there interested himself in the question of land-tenure and formed the opinion that the alienation of the people from the land was a mistake. In 1833 he entered the senior department of the military college at Sandhurst, but, though very successful as a student, was already losing interest in the army. In 1836 he and a Lieutenant Lushington made the colonial office an offer to conduct an expedition to explore the north-western coast of Australia. The offer was accepted, and they were instructed to proceed to the vicinity of Prince Regent's River and thence towards the Swan. They were to investigate north-western Australia, its resources, and the course and direction of its rivers and mountain ranges; to familiarize the natives with the British name

and character; to search for and record all information regarding the natural products of the country, and all details that might bear upon its capabilities for colonization; and to collect specimens of its natural history. Grey was appointed leader. A vessel was chartered at the Cape of Good Hope, and on 2 December the party reached Hanover Bay. For the history of this expedition see EXPLORATION BY LAND. Its most valuable result was the discovery of the Glenelg River and district, of which Grey wrote, 'I have never seen a richer tract of country than the extensive alluvial and basaltic districts in the neighbourhood of the Glenelg.'

Grey made a careful study of the aborigines, but was quite unable to enter into friendly relations with them. In some sandstone caves near the Glenelg he discovered rock-paintings that showed a comparatively high degree of artistic development, much superior to the undoubtedly aboriginal decorations of other caves near-by. He also noted among the aborigines a few lighter-coloured men, closely resembling the Malay type, who appeared to hold positions of authority.

On 27 April the party left Hanover Bay for the Mauritius, where they were obliged to stay for some months to recover from their hardships. Thence Grey set out for the Swan River to consult Sir James Stirling on the best means of continuing his work; while waiting at the settlement for a suitable vessel, he acquired an extensive knowledge of the native language and was able to compile a vocabulary of the different dialects spoken in the surrounding districts, which was forwarded to England at the end of the year. Having completed his preparations by the middle of February, he arranged for the conveyance of his party and five months' provisions to Shark Bay, whence he proposed to make excursions northward to North-west Cape and southward to Gantheaume Bay; he was finally obliged, however, to walk some 300 miles to Perth to seek help for the rest of his party. In Perth he continued his study of the native language, and the governor urged him to accept the position of government resident at King George's Sound, which was mainly associated with the administration of native affairs. Having learned, however, that the colonial office did not favour further expeditions to the north-west, Grey decided to return to England, and sailed from Adelaide on 11 April 1840. On his way home he prepared for the colonial office a memorandum on the treatment of Australian aborigines in which he urged that British law should be extended to govern not only the relations between natives and whites but also those between native and native; that a first violation by a native of the law (of which he was presumably ignorant) should be punished lightly, but with warning of a severe punishment for a second offence; that a mounted police force should be organized to protect the out-back settlers, who would then have no excuse for acts of vengeance; and that substantial rewards—preferably in the form of land grants—should be made to settlers who succeeded in educating natives to steady industry as well as to the natives who submitted to the process.

Grey arrived in England in September 1840, and was preparing his notes for publication when he was invited to take over the administration of South Australia. Having sold his army commission and made arrangements for the publication of his book (*Expeditions of Discovery in North-west and West Australia*), he set out for his new sphere of usefulness, reaching Adelaide on 14 May 1841. He found the colony bankrupt, his predecessor Gawler (q.v.) having pursued a public works policy which he had not the funds to carry through. Grey at once made drastic cuts in administrative expenses, and appointed a board to discover why over two thousand unemployed were receiving support from the public funds; on its report he cut down the dole until its recipients were practically forced to take employment in the country districts. At the same time the financial crisis forced many land-speculators to dispose of their holdings at a reasonable price to *bona fide* squatters and farmers, who willingly provided employment for the labourers from Adelaide. For surveys, road-building, etc., Grey drew on the revenue from land-sales instead of reserving this entirely for immigration expenses; and G. Fife Angas (q.v.) helped him greatly by sending out a good class of agricultural immigrant. The result of these measures was that between 1840 and 1843 the acreage of cultivated land increased from 2503 to 28,960, and the rural population from 6121 to 11,259, while the population of Adelaide decreased from 8489 to 6107. Besides this, the discovery of copper at Kapunda and Burra Burra helped to restore confidence, though it had little direct effect on the revenue until 1845. During this period of financial difficulty Grey retained the confidence of the colonial office. Nor was he less successful in his administration of native affairs, where he gave effect to his recommendations of 1840. He reversed Gawler's policy of treating natives beyond the settled districts as outside the Queen's allegiance, and brought them within reach of the law. In justice to those who were tempted to attack overland parties having only a weak escort, he required that such parties should be efficiently escorted, and stationed E. J. Eyre (q.v.) at a settlement in the interior to maintain order. He also induced some adult aboriginals to take a share in regular industry, established boarding-schools for native children at Walkerville and Encounter Bay, and rewarded settlers who demonstrably gave regular assistance to natives; but this policy was not continued after his departure. The colony having been set on its feet, the colonial office found other work for Grey. Both his financial and his native administration testified that he was the right man to rule New Zealand, which was distracted by repeated quarrels between the Maoris and the white settlers and between the New Zealand Company and the government. In November 1845 he became lieutenant-governor of New Zealand, and by conciliating the tribes that were at all friendly and hitting hard those that preferred to remain hostile soon established peace with the Maoris. The Company he dealt with in an analogous fashion; its defeat took longer, because it had powerful friends in London, but was effected in 1847. On 1 January 1848 Grey was made governor-in-chief over the islands of New Zealand; on 13 September 1852 he became governor of the colony of New Zealand, under a constitution mainly of his devising. At the end of 1853 he took leave of absence and returned to England, where the friends of the defunct New Zealand Company attacked him bitterly; but he soon justified himself to the colonial office, and was sent in 1854 to govern the Cape Colony. His tenure of office there was marked by (*a*) the restoration of peace with the Kaffir tribes by

methods such as he had used with the Maoris, (*b*) the introduction of German settlers of excellent quality, many of them ex-members of the German Legion that had been recruited for the Crimean war, (*c*) the campaign in favour of federation of the South African colonies which he carried on against the wish of the colonial office, and which directly occasioned his recall from the Cape in 1859. Also noteworthy was his prompt acceptance of responsibility when in August 1857 he received from India news of the outbreak of the Great Mutiny. Within three days he had despatched all the troops and military stores that South Africa could spare; immediately thereafter he seized on a body of troops that was on its way to the war in China, and insisted that it should be diverted to Calcutta—'this accidental reinforcement,' Lord Malmesbury wrote afterwards, 'probably saved India.'

In 1859, as has been said, the colonial office recalled him for having advocated federation; before he reached England, a new ministry was in power, and the new colonial secretary at Queen Victoria's request reappointed him to the Cape—but with the proviso that he must drop federation. Early in 1860 he returned to Cape Town, with the promise that at the end of his term he should be sent to Canada. But in 1861 New Zealand was in turmoil, and it seemed that only Grey could master the warring elements. Without demur he accepted the new burden, and landed in Auckland on 26 September 1861. The rest of his life was devoted to New Zealand—at first as governor (1861-8), then, after a few years of comparative quiet in England, as statesman; in 1874 he was elected by Auckland to the house of representatives, in 1877-9 he was premier of the colony, and for the rest of his life the inspirer of reforms and the trainer of younger politicians. John Ballance and Richard Seddon were two of his most notable pupils, and many of their contributions to New Zealand legislation—adult franchise, compulsory repurchase of private estates for closer settlement, triennial parliaments, taxation of land values—were largely inspired by him. In 1891 he was a delegate from New Zealand to the Australian federal convention of that year, and helped to secure manhood suffrage as the proposed federal franchise. His strength now failed him; in 1894 he went back to England, and died there on 20 September 1898.

Grey's work in three great colonies is his best memorial. But he left also to Cape Town a remarkable collection of books and manuscripts, and to Auckland another. His written work comprises two aboriginal vocabularies, the journal of his Western Australian explorations, and a valuable treatise on *Polynesian Mythology and Ancient Traditional History of the New Zealand Race* in which he collected a great number of Maori legends. His character, which impeded his progress as steadily as it enhanced his reputation, is thus summed up by William Pember Reeves, a colleague of his pupil Ballance:—'Against noble aims and a real love of lofty principle, against a life untainted by corruption or the grosser forms of self-seeking, must be set notable faults—the faults of a bold temperament and of an acute man of action, most of whose life was spent in command or controversy.' (K.C.B., 1848; P.C., 1895.)

Grey Jumper or **Apostle-bird,** rather a large perching bird (*Struthidea cinerea*), peculiar to Australia, of very doubtful affinities, but sometimes placed in the family of crows (Corvidae). It is grey, with pale brown wings and black tail, and with a short, arched bill. It is an inhabitant of the drier inland districts of eastern Australia, where it frequents trees, jumping from branch to branch. As it jumps,

Apostle-bird.

it throws up and spreads the wings and tail, and utters a harsh, unpleasant note. It is usually seen in small parties, and the name apostle-bird or 'twelve apostles' is derived from this habit. The same names are sometimes applied to the babblers (q.v.) which have a similar habit.

Grey jumpers feed on insects, especially large beetles. The nest is a deep basin of mud, lined with fine grass, and placed on the horizontal limb of a tree; and the eggs (which number from five to seven) are white, blotched at the larger end with brown, purple and grey. The nest is strikingly similar to that constructed by two other anomalous Australian birds, the magpie-lark (q.v.) and the chough (q.v.). W.B.A.

Grey Nurse. See SHARKS.

Grien, HENRI (1844-1921), born at Yverdun in Switzerland in 1844, first sprang into notoriety when—as Louis de Rougemont of Bordeaux—he reached London from New Zealand with a story of wild adventures on the north-western coast of Australia. At some time during the seventies of the last century he had been valet to a colonial governor; in 1878-9 he was a photographer at Port Douglas; then he became cook on a pearling schooner, and picked up from the crew stories of out-back adventure and a superficial knowledge of nautical affairs. Early in the nineties he drifted into Sydney and became waiter at a small restaurant in Newtown, there meeting Harry Stockdale (q.v.), an experienced bushman who during the eighties had explored the region behind Cambridge Gulf. Grien was also an inventor, and managed to get trial made of a diving-bell which dived once for all to the bottom of the harbour and drowned the two men in it; for this and other reasons the police began a search for him, and he slipped away to Wellington in New Zealand with some of Stockdale's journals, joined a group of spiritualists, and to impress them concocted from the journals and his pearling experiences strange stories of undiscovered islands and white women held in captivity by the aborigines. Failing to secure support in New Zealand, he made his way to London, arrived there in March 1898, and unloaded his budget of fables on the *Wide World Magazine*, then young and avid of sensation. His fame grew rapidly, and he was asked to lecture on his alleged explorations be-

fore the British Association for the Advancement of Science. Among untravelled English folk who could believe anything of far-away Australia, his tales were accepted without question—indeed, many of them were true, having been drawn either from Stockdale's journals or from the pearling episode. But his personal ignorance of the Australian bush was abysmal; and, when a few Australian residents of London heard him talk about 'flocks of wombats rising in the dusk' and similar miracles, the bubble burst. He then turned to itinerant lecturing, and abandoned his claim to truthfulness, allowing himself to be advertised in South Africa (in 1899) as 'the greatest liar on earth.' A subsequent lecture tour in Australia failed altogether, and he disappeared. But during the Great War he reappeared as an inventor, and seems to have made money out of a patent food to replace meat. In 1920, his health failing, he was admitted to the London Homoeopathic Hospital, and on 10 June 1921 died in the Kensington workhouse. His pseudonym 'de Rougemont' was borrowed without leave from a friend of the governor whom he had valeted. W.J.

Griffith, Sir Samuel Walker (1845-1920), born on 21 June 1845 at Merthyr Tydvil in Wales, was brought by his parents to New South Wales in 1854; they lived for a time in Ipswich (Q.) and Maitland (N.S.W.), and then settled in Brisbane. Young Griffith was educated at the university of Sydney (B.A., 1863; M.A., 1870) and gained therefrom the Mort travelling fellowship. After continuing his education in Europe by this means, he returned to Brisbane, was articled to Arthur Macalister, and in October 1867 was called to the bar of Queensland (Q.C., 1876). Soon acquiring a large practice, he could not rest content with his profession, but in November 1871 entered the Queensland legislative assembly as member for East Moreton, and on 3 August 1874 became attorney-general in the third Macalister ministry; for about ten weeks his future political antagonist-in-chief, Thomas McIlwraith (q.v.), was a colleague of his in this ministry. For the next five years he was continuously in office—as attorney-general and secretary for public instruction in the Thorn (1876-7) and Douglas (1877-9) ministries, and after September 1878 as secretary for public works under Douglas. With the defeat of Douglas began Griffith's ten-years' contest with McIlwraith, the latter holding office in 1879-82 and 1888-9, Griffith—who in those years led the Liberal opposition—forming his own ministry on 13 November 1883 and remaining premier until 13 June 1888. From 12 August 1890 to 13 March 1893 he was nominal head of a coalition ministry, with McIlwraith as his chief colleague, and on 14 March 1893 retired from politics to become chief justice of the colony.

These 22 years of political strife included a great deal of useful legislative work. In his second session, long before he took office, he fathered two acts, one a reform of equity procedure. While in the Macalister ministry he carried the important state education act of 1875, on which the Queensland educational system is based, and in the Thorn ministry was the colony's first secretary for public instruction. In 1876-7 he was mainly responsible for acts restraining the inflow of Asiatic and African immigrants to new goldfields—an early phase of the restrictions on alien immigration that have since become the normal Australian policy. His term in the Douglas ministry resulted in the local government act of 1878, the basis of all later measures on that subject. During his own term as premier in 1883-8 he passed acts establishing payment of members, throwing open great areas of crown lands to settlement, introducing the trade union system and the principle of employers' liability, and developing effectively his own local government scheme. The coalition ministry was less fruitful, as might have been expected, but included further dealings with crown lands and the appointment of a commission to formulate a scheme for a local university—a proposal which Griffith had made as far back as 1877, and persistently advocated until the university came into being in 1909. He also interested himself in Imperial affairs, attending the colonial conference of 1887 as one of the Queensland representatives, and taking an active part in the settlement of the administration of British New Guinea; at this conference also he brought forward tentatively the question of fiscal preference within the Empire. He had already (since 1880) worked hard for federation, and at the intercolonial conference of 1883 had carried a proposal for the setting up of a federal Australasian council, which in 1885 was embodied in an Imperial act. In 1888, 1891 and 1893 he presided over meetings of this council. He also represented Queensland at the preliminary federal conference of 1890 and at the convention of 1891, of which he was vice-president; he was chairman of the sub-committee which drafted the convention's bill, and the bill was in the main his personal work.

As chief justice of Queensland he took great care to isolate himself from all business of political interest—an isolation the more necessary because on several occasions (1898, 1899-1900, 1901-2) he acted as lieutenant-governor. He took up again the studies in law which had been somewhat interrupted by his political career, and became one of Australia's greatest constitutional lawyers, impressing even the British privy council with the depth of his attainments. In 1899 he completed the codification of Queensland's criminal law. Partly because of his official position, partly because Queensland had lost interest temporarily in Australian federation and was absorbed in disputes over local separation, he took no part in the federation campaign of 1897 and the following years; but he was a keenly interested observer, probably persuaded J. R. Dickson, then premier, to enter the premiers' conference of January 1899, and certainly influenced him—when in 1900 he went to England as delegate from Queensland to see the Commonwealth bill through the Imperial parliament—to advocate the deletion from the constitution of a clause by which no appeals were allowed from the federal high court to the British privy council. The final settlement of the dispute—by which appeals on constitutional questions are permitted only if the high court itself gives leave—was also of Griffith's devising.

When in 1903 the high court of Australia was actually established, Barton with the general approval of politicians and the public offered Griffith the chief justiceship. The choice was of great importance, for two reasons especially. In the first place, Griffith at once set a standard for the court's decisions and behaviour that it would now be almost impossible to alter; 'he prided himself' it has been said, 'on pro-

pounding the law as the expression of common sense in the regulation of all jural relationships.' In the second place, owing to the action of clause 74 of the constitution (the clause whose final form, as has already been mentioned, was due to him), the high court became the interpreter of the constitution in its minutest details, and Griffith's personality—dominant and rather conservative in his later life, and impatient of the many attempts to diminish State powers and enlarge the federal—swayed the decisions again and again. More especially in the new field of arbitration law did he maintain a stand *super antiquas vias* and limit the new court as straitly as might be. Apart from this (doubtless unconscious) bias his judicial greatness was unquestioned.

Apart from his profession Griffith was a constant patron of art and a literary student of great thoroughness. When codifying the criminal law of Queensland, he came to the conclusion that the Italian code was the best in the world, and in order to utilize it to the full studied the Italian language critically, thus acquiring the taste and skill which enabled him to produce a translation of Dante's *Inferno* (Sydney, 1908) in the measure of the original, and at a later date to complete the translation of the *Divina Commedia* (London, 1912). In 1904 he was made a member of the senate of the university of Sydney. In 1919 he resigned the chief justiceship of Australia, and lived quietly at Brisbane until his death, which occurred on 9 August 1920. (K.C.M.G., 1886; G.C.M.G., 1895; P.C., 1901.)

Grimes, CHARLES. Very little is known of Charles Grimes outside his career in New South Wales. He emerges from obscurity when appointed by the lords of the treasury to be deputy-surveyor of roads to the settlement in Australia in November 1790, and disappears again at Montreal in Canada in 1813. Grimes reached Sydney on 21 September 1791, and was despatched to Norfolk Island on 26 October in the vessel that also carried Lieutenant-governor King. On the island he aided Abbott and Piper to put down a mutiny of the New South Wales Corps garrison, but early in 1794 was recalled to Sydney owing to Alt's inability to cope with his work, and was stationed at Parramatta. For some years he was kept busy with surveys of grants near Sydney, except for a trip to Port Stephens in 1795, during which he was nearly killed by a treacherous aboriginal; his 'Plan of the Settlements in New South Wales' made in 1796 (which he signed as 'deputy-surveyor-general') is our most valuable authority for the Phillip-Grose-Hunter land grants, and he was responsible for the lay-out of the main road westwards from Duck Creek to beyond Toongabbie. On 13 April 1801 he was promoted to the surveyor-generalship on account of Alt's infirmity—he had been doing nearly the whole of Alt's work for some years; and in November of that year he went with Barrallier (q.v.) to the Hunter River to complete the survey already made in June by Grant and Barrallier in the *Lady Nelson*. In November 1802 he was again sent off, this time with Robbins in the *Cumberland*, to survey King Island and Port Phillip; King took occasion to describe him in a letter to Banks as 'a kind of mineralogist.' From 22 January to 22 February 1803 he was surveying the shores of Port Phillip, and on 3 February was one of the first party of white men to navigate the Yarra. His report on both the island and the port was unfavourable: indeed, none of his reports on districts outside the original settlement are encouraging, perhaps because he was already in the grip of the 'alarming illness,' on account of which King in August gave him leave to visit England. The six months in England which King named as the extreme limit of his leave spread out to 16, and it was not till 11 April 1806 that Grimes again reached Sydney; but his services had been recognized meanwhile, and he resumed work on a doubled salary. In 1807 he surveyed the Tamar and Derwent rivers, and returned to Sydney to become deeply involved in the Bligh mutiny. He had always been friendly with Macarthur, and King had rebuked him for it; it was at his house that Macarthur was arrested on 16 December, he signed the requisition to Johnston that was put forward as his authority for Bligh's arrest, and he was made judge-advocate on 30 January 1808 by the Johnston clique. On 22 February he was also made notary public to the colony, an office which seems to have carried with it the duty of performing civil marriages. He had previously had a good deal of magisterial experience, King having in 1800 made him resident magistrate at the Hawkesbury; but in his position as judge-advocate he had to admit that he was 'no lawyer—therefore incompetent to give a Law opinion,' and Johnston discovered that he would be more useful as a witness in England than as a judge in Sydney. He was accordingly sent off in the *Dart* on 16 April with Johnston's despatches, reached London in September, and spent the next two years in endeavours to collect arrears of pay; he was warned by the colonial office that his return to the colony would be forbidden and his pay stopped on account of his participation in the mutiny, and in July 1811 gave up hope and resigned the surveyor-generalship. (From one of his letters during this period we learn that he had done survey work for the government for several years before his appointment to New South Wales, but details are lacking.) It is interesting to note that, although the authorities in London refused to let him draw his pay, yet the amount was included in the colony's budget up to the end of 1811. Nothing else is known of him except that in 1813 he was living, 'well and very happy,' at Montreal; this would seem to indicate that he received his arrears of pay in the end.

Groper, a name applied to several distinct types of fish, including the Blue Groper (*Achoerodus gouldii*, for which see WRASSES), the Queensland Groper (*Promicrops lanceolatus*, for which see ROCK COD), and various species of *Epinephelus*, also mentioned under ROCK COD.

A.R.McC.

Grose, FRANCIS (1754-1814), born at Croydon Crooks in Surrey, England, was educated for military service and entered the army in 1775 (ensign, 1775; lieutenant, 1775; captain, 1779; major, 1783; lieutenant-colonel, 1795; colonel, 1798; major-general, 1805), serving in the American war and being present at the engagement on Bunker's Hill. Twice severely wounded in subsequent engagements, he returned to England in 1778 and for a time was employed in the recruiting service. On 8 June 1789 he was ordered (possibly owing to his personal friendship with Nepean) to raise and take command of a corps for service in New South Wales, afterwards known as the New South Wales Corps (q.v.); the ordinary method of

raising such a corps has light thrown on it by Grose's proposal to raise it entirely at his own expense provided he were allowed to nominate the officers and obtain £500 from 'the captain appointed to a majority.' On 2 November in the same year he was appointed lieutenant-governor of the new colony, and having sent on the corps in detachments (most of it as convict-guards in the second fleet) reached Sydney himself on 14 February 1792. For a time he confined himself to his duties as commandant of the corps—though an attempt in October to charter a vessel expressly to fetch provisions for the corps from the Cape of Good Hope foreshadowed the trading autocracy that was soon to follow. But on 11 December Phillip, who had long been overworked and anxious for a holiday, sailed to England and left Grose in command of the whole settlement.

This was unfortunate both for Grose and for the settlement. He was emphatically a military man, devoted to the service and putting its needs (or the needs of its personnel) above all other objects. In his view the prosperity of the settlement could only be assured by establishing everywhere the control of the corps. He therefore (*a*) abolished the jurisdiction of the civilian magistrates except where he himself should specially direct them to exercise it; (*b*) abolished Phillip's system of using convict labour to grow provisions for general use and substituted one under which convict labour was distributed among officers and free settlers (of the latter there were then very few); (*c*) made liberal grants of land to all military officers who wanted it, and allowed them to pick their areas patchwork fashion, without considering the plan of roads, etc., which Phillip had constructed. The narrowness and crookedness of many Sydney streets dates from Grose's time, and contrasts unfavourably with Phillip's admirable scheme for the town. His sincerity in all this there is no reason to question. Hunter, who objected strongly to most of Grose's measures, wrote that in his opinion the distribution of convict labourers among officers who had farms had been 'the principal means by which this colony has arrived at that state of improvement in which I have found it.' But Grose's confidence in the ability and unselfishness of his fellow-officers was misplaced; many of them had taken commissions in the corps mainly because they hoped to better themselves financially, and when they found themselves in the saddle they dropped all pretence of professional zeal and became purely and simply business men. It was because they obtained the practical monopoly of grain-growing, and found it more profitable to convert the grain into alcohol than to sell it as flour, that the notorious traffic in spirits began, which was to harass two governors almost beyond endurance and cause the forcible deposition of a third. It is also to Grose's discredit that he took serious offence at the action of Richard Johnson, the chaplain, in building at his own expense a church for the settlement and then suggesting that some part of the cost might be borne by the government.

Worried by administrative work outside his normal capacity, and by the breaking out of his old wounds during the hot weather, Grose on 16 December 1794 left the settlement in charge of Captain Paterson (q.v.) and sailed for England. There, after a term of rest on half-pay, he was appointed to the staff in Ireland (1798) and subsequently to Gibraltar (1805), invalided home in 1807, and replaced in Ireland in 1809. In that year he applied for the governorship of New South Wales, but it was given to Macquarie. He retained his colonelcy of the corps until 1807. Of his later years nothing is known, but he died at Croydon in June 1814.

His father Francis Grose, artist and antiquary, was an acquaintance of Robert Burns, and is referred to in the well-known lines

'A chiel's amang ye taking notes,
And, faith, he'll prent it.'

Ground-birds and Scrub-robins, terrestrial birds belonging to the genera *Cinclosoma* and *Drymodes*—both peculiar to the Australian region and almost certainly allied to one another, though their true classification is very

Spotted Ground-bird.

doubtful. They have been assigned by different writers to the thrushes (Turdidae), chats (Saxicolidae), warblers (Sylviidae) and babblers (Timaliidae).

Of ground-birds or ground-thrushes (*Cinclosoma*) there are five species, four found in Australia (one extending to Tasmania), and one peculiar to New Guinea. They are mostly inland birds, found among rocks and underwood, of about the size of a thrush, brownish or rufous above, and lighter below. They feed on insects and seeds, and run along the ground with a gait resembling that of the little ground-doves. When disturbed, they usually endeavour to escape by running; if forced to fly, they rise with a whirr of the wings like quail, and fly heavily in a series of undulations for a short distance before pitching suddenly to the ground again. Occasionally they fly up into the lower branches of shrubs. Their note is a low piping whistle. The best-known species are the Spotted Ground-bird (*C. punctatum*) of south-eastern Australia and Tasmania, and the Chestnut-backed Ground-bird (*C. castanotum*) of the inland districts of south-eastern Australia.

Of scrub-robins (*Drymodes*) there are three species, two occurring in Australia and the third in New Guinea and the Aru Islands. They are shy, rather smaller than ground-birds, chestnut-brown above and dirty-white below, usually frequenting stony ground in open scrub country, and spending most of their time moving by fits and starts along the ground. They utter a sharp whistling note. One species, *D. brunneopygius*, is found in the inland districts of the southern States, the other, *D. superciliaris*, in the Northern Territory and northern Queensland.

Both ground-birds and scrub-robins build open, cup-shaped nests of sticks, bark, and leaves on the ground, at the foot of a tree or bush, and lay two or three white or greyish eggs, blotched with brown. W.B.A.

Ground-thrush. See GROUND-BIRDS and THRUSHES.

Ground-wrens and Field-wrens, small birds frequenting open scrub country, belonging to the genera *Hylacola* and *Calamanthus,* both confined to Australia. They are undoubtedly near relatives, but their classification is uncertain; by some writers they are grouped with the warblers (Sylviidae) and by others with the babblers (Timaliidae). There is little doubt that they are related to the scrub-wrens (*Sericornis*).

Both ground-wrens and field-wrens are rather shy, hopping about on the ground or perching on bushes, and generally carrying the tail upright over the back. They have an agreeable note, and build dome-shaped nests low down in a thick bush, or on the ground amongst dense herbage.

The Chestnut-rumped Ground-wren (*H. pyrrhopygia*) inhabits south-eastern Australia; the Rufous-rumped Ground-wren (*H. cauta*) is found in southern and south-western Australia. They are both brown above, white below with brown spots, and with a black band across the tail; the brightly-coloured base of the tail gives these birds their English name. The Field-wren (*C. campestris*) occurs in southern, central and western Australia, the Striated Field-wren (*C. fuliginosus*) is found in Tasmania and south-eastern Australia, and the Rock Field-wren (*C. montanellus*) in the south-west. They are brown above and whitish below, with blackish streaks almost all over them, and with a black band across the tail. They emit so strong a scent that game-dogs stand to them as to quail; thus they may be regarded as the very smallest of game-birds. W.B.A.

Grunter. See SILVER PERCH.

Grylls, JOHN COUCH (1796-1854), born in 1796 and educated at Dublin and Cambridge, entered the ministry of the Church of England, and in 1838 proceeded to Sydney to serve under Bishop Broughton. On 11 September 1838 he was appointed to the charge of the Church of England at Port Phillip, and reached Melbourne on 11 October; his first services were conducted in a small wooden building near William-street, and close to it on 6 November 1839 was laid the foundation-stone of St. James's church, which for many years was used as the cathedral of the diocese of Melbourne. Within a few weeks of his arrival Grylls had been made by Lonsdale (who was then in charge of the district) a trustee of the local savings bank. But his stay in Melbourne was short; by 1840 he was back in England to bring out his family, and on returning to Australia was made locum tenens at St. Philip's, Sydney, for Dr. William Cowper (q.v.) who was forced to visit England for eye-trouble. On Cowper's return Grylls became his curate, and soon afterwards was chosen one of the first canons of St. Andrew's cathedral. In October 1847 he retired, and went back to England, where he died on 22 April 1854.

Guardfish. See GARFISHES.

Gudgeons, members of the family Eleotridae, and near relatives of the gobies. These small fish occur in the sea, estuaries, and fresh water. Some even inhabit the streams and waterholes of the central Australian desert region; these have the power of aestivating during periods of drought—that is, by suspending animation while lying encased in dry mud, they survive until the return of wet weather revives them. One small species of the genus *Carassiops* is occasionally lifted from shallow pools by whirlwinds and, together with shrimps and water-snails, is carried alive for short distances, to be dropped as from the clouds; such an occurrence is sometimes noted in the press as a 'rain of fish.' Most of the numerous species occurring in Australia are but a few inches in length, but some are large enough to be useful as food-fish, and one (*Oxyeleotris lineolatus*) attains a length of 19 inches. A.R.McC.

Guerard, EUGENE VON. See ART.

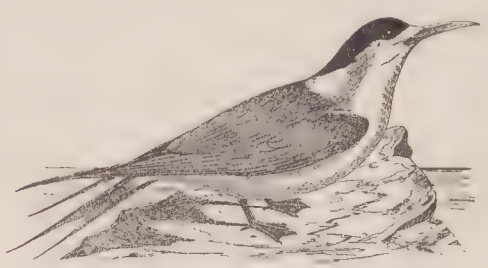
Guettarda, a tropical genus of the family Rubiaceae, consisting of shrubs. The only species indigenous to Australia, *G. speciosa,* is a coastal plant 5-6 feet high with large, fragrant, stalkless flowers scattered along the branches. The fruit is a drupe. In India a perfume is distilled from the flowers.

Guinea-a-week. See PILOT-BIRD.

Guitar-fish. See SHOVEL-NOSED RAYS.

Gulls, Terns, and Skuas, water-birds of the order Lariformes, which frequent sea-coasts, large lakes, and rivers. Gulls proper (Laridae) are represented in Australia by two species only; of these the Silver Gull (*Larus novaehollandiae*), a small white species with silver-grey wings and red beak and legs, is common all round the coast and extends to New Caledonia and New Zealand, but the Pacific Gull (*Gabianus pacificus*), a much larger form with black back and wings and a very strong yellow beak, is found only round the coasts of southern Australia and Tasmania.

Terns or sea-swallows (Sternidae) are much more numerous (16 species) on the Australian coast, and, though classed as sea-gulls in popular parlance, differ from them markedly in appearance and habits. Gulls are scavengers, with shortish, rounded bills and rounded wings and tail; terns have sharp, pointed beaks, pointed wings and forked tails, and live entirely on fish, for which they dive while flying. The largest is the Caspian Tern (*Hydroprogne caspia*), which nearly equals in size the Pacific gull, and has a stout red bill. It is widely distributed on Australian coasts, though nowhere very plentiful, and is also found through the greater part of the world. The commonest is the Crested Tern



Crested Tern.

(*Thalasseus bergii*) a large species with a black crest on its head, and a yellow bill. It is found throughout the western Pacific and the Indian oceans. The little fairy terns or ternlets are also common, the species found on the southern

TERNS' EGGS

Plate XVII

Drawn by N. W. Cayley and F. S. Rodriguez.

1 and 2. Noddy (*Anous stolidus*).
3. Grey Noddy (*Procelsterna cinerea*).
4. Lesser Noddy (*Anous tenuirostris*).
5 and 6. Whitecapped Noddy (*Anous minutus*).
7, 8 and 9. White Tern (*Gygis candida*).

coasts (*Sternula nereis*) being peculiar to Australia; on the eastern and northern coasts is found another species (*S. albifrons*) which ranges over the greater part of the old world.

Terns usually breed in colonies on small islands or sandbanks, placing their eggs in a hollow on the ground. On the islands round our northern coast-line some species occur in immense numbers, particularly the Sooty Tern (*Sterna fuscata*) and the Noddy (*Anous stolidus*). The latter is remarkable among terns in that it builds a nest of seaweed on the tops of bushes. Still more remarkable are the nests of the Lesser Noddy (*Anous tenuirostris*), which builds a fairly compact structure of seaweed in the branches of mangrove-trees. This last species nests only in the Houtman Abrolhos group and in the Seychelles. In 1841, when the birds were discovered on the Abrolhos, they were in immense numbers, and flights of them were said to darken the air. Since that time they have steadily declined in number, and are evidently on the road to extinction; the cause of this is not known.

Several species of tern usually inhabit lakes and large swamps, being often found far from the sea. In Australia the Gull-billed Tern (*Gelochelidon nilotica*) and the Marsh Tern (*Chlidonias leucopareia*) are the principal inland forms; both species occur in similar localities throughout the greater part of the world.

Skuas (Stercorariidae) are stout, dark-coloured, gull-like birds with hooked beaks. They pursue other sea-birds, making them disgorge their prey, which is caught by the pirate before it reaches the water. Two species are regular visitors to Australian seas, one the Antarctic Skua (*Catharacta lonnbergi*)—in New Zealand known as the Port Egmont hen—a winter visitor which breeds farther south, the other the Arctic Skua (*Stercorarius parasiticus*), a summer visitor which breeds in the arctic regions during our winter.

W.B.A.

Gums. See EUCALYPTUS.

Gunn, RONALD CAMPBELL (1808-1881), born at Cape Town on 4 April 1808 (his father being a lieutenant in the garrison there), was educated in England for the army and attached to the royal engineers' office at Barbados, but in 1829 migrated to Tasmania, where he was made superintendent of convicts (1830) and police magistrate at Circular Head (1836). In 1838 he was transferred to Hobart, and in 1839 became private secretary to Sir John Franklin, succeeding Alexander Maconochie (q.v.). In 1841 he left the public service to take charge of a large estate near Longford in northern Tasmania, employing his spare time for the next 14 years in botanical researches; from 1844 onwards he was secretary of the Tasmanian Society and a frequent contributor to its journal. In 1855 he was elected by Launceston to the legislative council, and when the two-chambered constitution came into working in 1856 was returned to the legislative assembly by Selby. From 1860 to 1876 he held minor official posts at Launceston, and in 1864 was appointed by the Tasmanian government (at the request of the government of New Zealand) one of three commissioners to choose the New Zealand capital. But his life's work and the service for which he is chiefly honoured in Tasmania was scientific investigation. In 1854 he was elected a fellow of the Royal Society; Joseph Hooker and William Harvey were his firm friends and admirers; a genus and more than 50 species of Australian plants were named after him, most of them by Hooker. He died at Launceston on 13 March 1881.

Gurnard Perch. See RED ROCK COD.

Gurnards, fishes of the family Triglidae; they abound in Australian waters, but are mostly so small as to be of little value commercially. All gurnards have the head encased in a bony armament, and there are often some bony plates covering the body also. Characteristic are the lower rays of the pectoral fins, which are free, thickened and curved, and serve as limbs upon which the fish creeps about. The upper part of the pectoral fin is greatly enlarged, and ornamented with marvellously brilliant colours, such as large black ocelli with rings of green, blue and gold. The so-called Flying Gurnard (*Pterygotrigla polyommata*) of southern and south-eastern Australia gets its name from its particularly enlarged pectoral fins; but it lives in depths of 50-100 fathoms and is quite incapable of flight. It is of a beautiful pink colour, and, being taken plenti-

Flying Gurnard.

fully by trawlers, has become a well-known food-fish. Another species, the Red Gurnard (*Chelidonichthys kumu*) is likewise seen in the markets, but less plentifully than the other; various representatives of the genera *Paratrigla* and *Lepidotrigla* are captured in the trawl, but are too small to be of value as food-fishes.

The true Flying Gurnard (*Dactyloptena orientalis*) belongs to an allied family of which all the members inhabit the tropics. They have greatly enlarged pectoral fins, which enable them to leap from the water and glide rapidly through the air like true flying-fish. Several species recorded from Australian waters are beautifully ornamented with brown markings, and the head and body are covered with wonderfully sculptured bony plates and scales.

A.R.McC.

Gurnet. See RED ROCK COD.

Guttiferae, a tropical family of trees. One species—*Calophyllum inophyllum* (Alexandrian Laurel or Dilo), a handsome forest tree which thrives best in coastal situations—is indigenous to northern Australia. It is grown for shade and for its fragrant flowers, but especially for the fruit; from this an oil is extracted, which in India and Fiji is used both as an illuminant and to cure rheumatism; when freed

from resin it makes an excellent soap. It also mixes well with pigments. The tree yields a useful timber.

Gymea. See AMARYLLIDACEAE.

Gymnostachys, a genus of the family Araceae, consisting of one species, *G. anceps* (Settlers' Twine), which is endemic in Australia. It is an erect herb with tuberous roots and long, narrow, tufted leaves. The flowers are small, loosely packed in slender spikes, the petals and sepals represented by 4 scale-like segments; flower-stems flattened, carrying clusters of 3-4 spikes some distance apart on the upper portion, each cluster subtended by a rigid, erect, leafly bract; fruit an oval berry. The plant yields a coarse fibre, often used for some purpose where particular strength is required, e.g. sewing up bags or tying the legs of pigs for market; hence the popular name. Before using, settlers usually singe the leaves by drawing them over hot ashes.

Gypsum is found in New South Wales, Victoria, South Australia and Western Australia, but until 1921 was not commercially exploited except in Victoria and South Australia. The Victorian deposits near Boort (between the Loddon and Avoca rivers) have been worked steadily for many years, and are becoming exhausted: in 1902 3227 tons were raised there, in 1922 only 331 tons. Fresh deposits have been opened up on the lower Loddon at Lake Boga and westwards as far as Lake Tyrrell, and the total Victorian production in 1922 was 6945 tons. In South Australia the deposits in the southern end of Yorke Peninsula have also been worked for many years at Lake Fowler and Marion Bay; recently large deposits were discovered near Penong inland from Fowler's Bay on the Bight.

Since 1921 the New South Wales deposits have been slowly opened up, chiefly near Hay on the Murrumbidgee and Hillston on the Lachlan; a third field was opened in 1925 between Bourke on the Darling and Wanaaring. In Western Australia gypsum is widely distributed; it occurs usually near salt lakes of the arid non-tropical interior, especially Lake Austin on the Murchison goldfield and Lake Seabrook north of Southern Cross. Little exploitation has yet been effected. The following figures will illustrate the progress of the industry:—

	1917	1920	1922
	tons	tons	tons
New South Wales ..	——	——	1692
Victoria	1187	3393	6945
South Australia	12,776	40,192	45,241
Western Australia	——	——	63

Besides its use in making high-grade plaster of Paris and cement, gypsum is of value as a fertilizer, especially in irrigation districts.

H

Hackett, Sir John Winthrop (1848-1916), born in Ireland, educated at Trinity College, Dublin (M.A., 1873; hon. LL.D., 1902) and called to the Irish bar in 1874, practised for a time in Dublin. Migrating to Australia, he was admitted to the New South Wales bar, but soon went over to Melbourne, where he became subwarden of Trinity College in the university. Having been admitted to the Victorian bar, he resigned his position at the university in 1882, unsuccessfully endeavoured to enter the legislative assembly, and at the end of the year left for Western Australia, where he intended to take up land. Next year, however, he became joint owner of the *West Australian* newspaper, of which in 1887 he made himself editor, retaining the position until his death. In 1890 he was nominated to the legislative council, and retained his seat at successive elections. Though he never accepted any cabinet appointment, he was for many years the 'power behind the throne' in Western Australia. To him are due practically all the State's educational and recreative institutions, such as the public library, museum, art gallery, zoological gardens, King's park, and university. Of these various institutions he was chairman or president; and he was the first chancellor of the university, occupying that position until his death. He was a member of the federal conventions of 1891 and 1897-8, which framed the constitution; in 1895, 1897 and 1899 he was a delegate to the federal council of Australasia. He died in February 1916. (Kt. Bach., 1911; K.C.M.G., 1913.) J.S.B.

Haemodoraceae, a family of herbs endemic in Western Australia, though one genus (*Haemodorum*) is found outside that State, ranging from Western Australia across the continent and extending to Tasmania. The thickened base of the erect stem, swollen and somewhat bulbous, is enclosed in the persistent sheathing bases of the leaves; flowers black, red, green, or yellow, frequently fragrant. A red exudation from the roots has given rise to the popular name 'blood-root.' The thickened bases of the stems of several Western Australian species are used as food by the aborigines. See Kangaroo Paws.

Haines, William Clarke (1807-1866), born in England and educated for the medical profession (he practised there for some years as a surgeon), in 1848 migrated to Victoria, took up farming on the Barrabool hills near Geelong, and in 1851 was nominated to the new council as a non-official member. In 1854 he succeeded J. V. F. Foster as colonial secretary, held office till the introduction of responsible government, became (after minor mishaps and intrigues) first premier under the new constitution, and held this office, with one slight interval, from 28 November 1855 to 10 March 1858—for the last year in partnership with James McCulloch. Deprived of office, he spent three years in European travel, and returned to accept the treasurership under his old opponent John O'Shanassy, the link being an objection to undenominational State education. The coalition lasted from 14 November 1861 to 27 June 1863, when it was defeated on its land administration. Haines retired into private life, and died on 3 February 1866. Although his ministry carried the universal manhood suffrage act of 1857, he was by temperament conservative and slow of thought; his value to the community lay rather in his unquestioned integrity, and his example of courteous patience in times when the machinery of politics was new and its would-be drivers often vehement and rash. Some authorities identify him with William 'Charles' Haines who in 1843 was a member of the Grant district council. If so, he migrated to Victoria in or before 1843.

Hair-tails, long, ribbon-shaped fishes of the genus *Trichiurus,* silvery in colour and with the body drawn out into a long pointed tail. Several closely allied species occur in temperate and tropical waters of both hemispheres; one occasionally appears in plenty off the coast of New South Wales, apparently coming from deep water, and another swims in small schools among the mangroves of northern Queensland. The New South Wales species is commonly confused with the true ribbon-fish and the frost-fish, but is quite distinct from both. A.R.McC.

Hakea, a genus of the family Proteaceae, consisting of shrubs or (rarely) small trees, with 107 species all endemic in Australia. The corolla-tube is curved (rarely straight), the segments cohering above after the tube has opened; fruit a hard woody capsule, opening in two valves; seeds 2, compressed and produced into a broad membranous wing; leaves alternate, diverse in shape from flat to cylindrical. The section with cylindrical leaves includes the prickly 'needle-bushes.' *H. lorea* (Western Cork-tree) has leaves two feet long; *H. saligna* (Willow-leaved Hakea), an eastern species, is a small tree of 15-20 feet, with fragrant flowers. All species are readily propagated from seeds. See Needlewood.

Hale, Matthew Blagden (1811-1895), born in 1811 at Alderley in Gloucestershire, was a descendant of the celebrated judge Sir Matthew Hale. Educated at Trinity College, Cambridge, he entered the Anglican ministry (deacon, 1836; priest, 1837), and after ten years of parochial work in England was persuaded by Bishop Short (q.v.), who had just been appointed to Adelaide, to come out with him as archdeacon. Arriving in December 1847, he almost immediately founded a school for aboriginal children, which in September 1850 he transferred to land he had bought at Poonindie near Port Lincoln. For seven years he super-

intended this school, but in 1856 resigned his archdeaconry to take up episcopal duties at Perth in Western Australia, of which he was the first bishop (consecrated at Lambeth on 25 July 1857). After a long administration, during which he founded many churches and schools—including 'The Bishop's School' at Perth (now the high school), opened on 28 June 1858—he was translated to Brisbane in 1875 on the unanimous nomination of the Australian bishops. During the eight years of his Brisbane episcopate he devised and organized the diocese of North Queensland, and established a superannuation fund and a home mission fund, aiding the latter repeatedly with generous personal donations. He resigned in March 1885, returned to England, resumed parochial work in Gloucestershire, and died on 5 April 1895.

Half-beak. See GARFISHES.

Halibut. See FLOUNDERS.

Hall, BENJAMIN (1837-1865), born at Breeza in New South Wales in February 1837 and educated as a child at Murrurundi, helped his father on a station in the Lachlan district until 1852, when the elder Hall returned to Murrurundi. Ben Hall then leased a run near Wheogo in the Grenfell district, and soon gained a reputation for honesty and enterprise. But early in 1862 he was suddenly deserted by his wife and charged by the police with highway robbery, though when tried at Orange the jury acquitted him without leaving the box. A few weeks later he was again arrested on the charge of being concerned in the Eugowra gold-robbery (see GARDINER, FRANK). The two arrests and the consequent proceedings occupied nearly four months, and on his return to the station he found his stock either strayed or dead. A few weeks later he was found by the police in company with an undoubted member of Gardiner's gang: they chased and fired upon him, and in desperation he determined to join the gang. When Frank Gardiner towards the end of 1862 disappeared into Queensland, Hall became the gang's recognized leader, and its most famous exploits were carried out under his direction. They included the sticking-up of the Commercial Bank at Carcoar in July 1863, the chase and capture of a detachment of police in August, the raid on Canowindra (which the gang occupied for three days) in September, the daring visit to Bathurst on 3 October and its more business-like sequel of the 6th, the capture and ransoming of Keightley the gold-commissioner on the 24th, and the burning of Goimbla homestead, near Forbes, on 19 November. By that time two of the gang—Burke and O'Meally—had been killed, and a third, Vane, had given himself up: Hall then separated from Gilbert, and during the summer worked alone. But in May 1864 a raid on Koorowatha, between Cowra and Young, disclosed the fact that Hall and Gilbert had again joined forces and obtained a new recruit, Johnny Dunn. Hall now altered his tactics and concentrated on the sticking-up of mail-coaches: of this period some details are given under BUSHRANGING. The *Yass Courier* of 19 November announced cheerfully that he seemed 'to have obtained a lease of the main southern road;' before the end of the year he was robbing drays north of Goulburn: towards the end of January 1865 the gang raided Collector, south of that town, and in March made an unsuccessful attack on the gold escort from Araluen. In April they left the southern district and made back to their old haunts near Young and Forbes, and on 6 May Hall, whose companions had gone ahead of him, was surrounded and shot down by a party of police. Gilbert was trapped and shot on the 12th, and Dunn, though he escaped for a time, was caught at the year's end and hanged on 19 March 1866.

Hall was probably the least brutal of all the well-known bushrangers. It is clear that nothing but domestic misfortunes and what seemed to him police persecution drove him into Gardiner's arms: and a year after he had taken to the bush he was described by a mail-coach passenger as 'a rather tall, robust-looking man with a fine, frank-looking face.'

Hall, EDWARD SMITH (1786-1860), is first mentioned in a despatch from Sir R. Peel (then under-secretary for the colonies) to Macquarie, dated 20 December 1810, as an intending immigrant strongly recommended by William Wilberforce and others. He reached Sydney on 25 October 1812, but failed to gain Macquarie's favour; he apparently knew nothing of farming, and by 1814 had 'commenced merchant' at Sydney and joined Simeon Lord in promoting a company to trade with New Zealand. Already, however, as might be expected of a friend of Wilberforce, he had embarked on philanthropic work, founding on 8 May 1813 the Benevolent Society of New South Wales, of which he was the first secretary. In 1817 he became the first secretary and cashier of the Bank of New South Wales, but appears not to have liked the work, for in 1818 he resigned his position and applied (through friends in England) for leave to practise as an attorney in the local courts; though Bathurst felt compelled to refuse this request of an untrained man, he took the opportunity to repeat Peel's recommendations, and Macquarie compromised by making Hall coroner. When Darling became governor, Bathurst renewed his recommendation—which on this occasion was of no effect. In May 1826 Hall (who was at the time 'needy,' if Saxe Bannister may be believed) issued the first number of the *Monitor*, in which he praised Darling's administration; but by July he was criticizing official proceedings with a severity that drove Darling to prosecute him for libel; and, though that particular prosecution was withdrawn, Hall's outspokenness and Darling's impatience of even reasonable criticism resulted in seven libel actions within a few months afterwards, fines running into hundreds of pounds, and sentences that aggregated three years. Darling was undoubtedly very angry. He denounced Hall as a 'fellow without principle, an Apostate Missionary,' adding—as if somehow that aggravated the offence—that he was a widower with eight young children, and poor. A little later the governor tried to curb the press by imposing a fourpenny stamp duty on each copy. To avoid this heavy impost Hall published the *Monitor* as a weekly magazine, and was prosecuted again. An attack on Archdeacon Scott as 'not a man of peace' brought along another prosecution and more fines, while the archdeacon first locked up and then boarded over Hall's pew in St. James's church. Nor did Darling confine himself to legal proceedings; he deprived Hall of his right to lease pastureland, took away the convict servants who had been assigned to him, and forbade the employees of the government printer to employ their spare time in getting out the *Monitor*. This series of annoyances and prosecutions lasted until 1830, when—Hall being at the time in gaol—Darling released him in honour of the acces-

sion of King William IV, and he became paid secretary to the Patriotic Association. Thenceforth Hall disappears from Australian history as suddenly as he came into it. Even his share in procuring, by gallant if not vehement struggles, the freedom of the Australian press is obscured by the better-known achievements of Francis Forbes (q.v.) and W. C. Wentworth (q.v.). But the friend of Wilberforce and Canning, the founder of Sydney's Benevolent Society, and the unbribable and undefeatable opponent of Darling's high-handedness well deserves a fame of his own. He died on 18 September 1860.

Halloran, Laurence Henry, is first heard of about 1790 as conducting the grammar school of Alphington near Exeter in England, where Robert Gifford, afterwards chief justice of England, was one of his pupils. In 1807-11 Halloran was chaplain to the garrison at Cape Town in South Africa, but quarrelled with Lord Caledon, then governor of The Cape Colony, and bitterly attacked General Grey, the commander of the garrison; he was therefore sent back to England, and disappears from view until in October 1818 he was convicted of having forged a frank to a letter and (though a layman) having obtained a curacy thereby. 'He persisted in pleading guilty' says the report of the case, 'because, he said, the only person who could establish his innocence was dead.' As he was a doctor of divinity and had been tutor to several notables of the day, his case attracted attention and was discussed in the house of commons. Transported for seven years to Australia, he reached Port Jackson in the transport *Baring* on 26 June 1819, and found an old Cape Town friend in J. T. Campbell, then Macquarie's secretary. On Campbell's recommendation Halloran received a ticket of leave; but, certain grave charges which he made against the master of the *Baring* being considered by the magistrates false and malicious, his ticket was cancelled and he was assigned as a servant to Simeon Lord, with whom he was already in favour. Having obtained a second ticket of leave, he was allowed by Lord to open a school, and soon became, to use Macquarie's words, 'the best and most admired Instructor of Youth in this Colony.' Bigge —who was acquainted with his English record and astonished to find him teaching boys in Sydney—had to admit that the school was well conducted, remarkably efficient, and preferred by the principal residents to one kept by the official schoolmaster Thomas Reddall.

Whatever Halloran's defects were, he could teach. Brisbane reported in 1825 that he managed his school with much credit to himself, and in a private letter testified to his 'assiduity, ability, and success,' as well as to his good conduct as a citizen and a journalist. On 4 November 1825 he was chosen headmaster of a free grammar school founded by free settlers and military officers; but the scheme failed, and Halloran found himself so debt-ridden that he spent some time in gaol. Set free again early in 1827, he at once put before Darling a proposal for a public free grammar school to be held in Simeon Lord's house in Macquarie Place. Darling snubbed him, and he promptly started a newspaper, *The Gleaner*, whose first issue appeared on 5 April 1827 and its last on 29 September of the same year. Quaintly enough, Darling had hopes that he might intend to support the government against the attacks of Wentworth and Hall; 'he writes well,' the governor told the colonial office, 'though intemperately.' In 1828 Darling made him coroner (unaccountably neglecting to report the appointment to England), but in September of the same year cancelled the appointment because Halloran had quarrelled with Archdeacon Scott and threatened to publish defamatory documents about him. In this case, at any rate, Halloran had extreme provocation; because he had prefaced his Sunday lectures at the court-house with prayers from the Anglican liturgy, not having obtained permission from Scott to do so, his lectures were prohibited, his pew in St. James's church was taken from him, and an appointment with the Australian Agricultural Company that had been obtained for him by John Macarthur was withheld owing to Scott's interference. As a last resource he opened in 1830 a 'memorial office' wherein persons with a grievance against the government might have their wrongs persuasively set forth for official perusal in London. He died on 7 March 1831.

From first to last Halloran's besetting vice was quarrelsomeness. He quarrelled with the Cape Town authorities, and was sent back to England. It was a quarrel with the clergyman whose curate he had been that brought about his trial and conviction in 1818. He quarrelled with the master of the *Baring* (and lost his ticket of leave), with his gaoler in 1826, with Archdeacon Scott in 1828, and in the same year with Father J. J. Therry (q.v.), who refused to accept from him a donation towards the building of St. Mary's church. The bitterness with which his enemies in England pursued him, however, was probably due to the fact that he had during the 1811-17 period by means of forged letters pretended that he was an ordained priest, obtained curacies thereby, and celebrated marriages which were in fact no marriages at all, thus causing great distress to the unfortunate couples concerned.

His son Henry Halloran (1811-1893), born at Cape Town in 1811, was educated at the father's school in Sydney and in 1827 entered the survey office as a clerk. In 1830 he narrowly escaped dismissal for having copied out a memorial compiled by his father for a government contractor who supplied bad bread. Darling wished to dismiss him, but the colonial office was more lenient. Thereafter, pursuing his career through various grades of the public service, he rose in 1866 to be principal undersecretary, and held the post until his resignation in 1878. Outside his work his main interests were military (in 1854-71 he was lieutenant in the volunteer mounted forces) and literary. His verse gained the praise of D. H. Deniehy, but is purely imitative and mildly pleasing; his best service to literature was probably his encouragement of Henry Kendall, for whom in 1863 he obtained a clerkship in the survey office. The verse, scattered through newspapers, magazines, and pamphlets, was collected in 1887 under the title *Poems, Odes, Songs.* Halloran died at Ashfield on 19 May 1893. (C.M.G., 1878.)

Hamilton, Sir Robert George Crookshank (1836-1895), born on 30 August 1836 at Bressay in the Shetlands and educated at University and King's College, Aberdeen (M.A., 1857; LL.D., 1885), in 1855 was appointed to the war office and sent as a commissariat clerk to the Crimea. During a long career in the civil service he served in the office of works (1857-61), the education department (1861-9), the board of trade (1869-78), and the navy office (1878-82). Being then lent to the Irish office to fill the under-secretaryship, he was in

1883 made permanent under-secretary, but removed in December 1886 by the incoming Unionist ministry on account of his home rule sympathies. He was made governor of Tasmania early in 1887, held that post until 1893, and on his return to England was appointed by the then Liberal ministry to various colonial and financial commissions, and in November 1894 made chairman of the board of customs. He died in London on 22 April 1895. An able and industrious civil servant, he had few opportunities during his Australian period for showing his capabilities. (C.B., 1883; K.C.B., 1884.)

Hammer-headed Sharks, members of the family Sphyrnidae, having the head peculiarly flattened, and produced into a broad, flat lobe on each side upon which the eyes are placed. The purpose or value of this extraordinary development is unknown, and it is undoubtedly one of the most remarkable modifications found among fishes. Half a dozen species are known, some of which range over all temperate and tropical seas and, attaining a large size, are dangerous to man. The others are smaller and more restricted in their distribution. Each female produces a large number of young, which are born alive. A common species in Australian waters is *Sphyrna zygaena,* which attains a length of at least 15 feet. A.R.McC.

Hampden, Viscount. Henry Robert Brand, second viscount Hampden (1841-1906), born on 2 May 1841 and educated at Rugby, held a commission in the Coldstream Guards from 1858 to 1861-2, being aide-de-camp to the governor-general of Canada. He was twice a member of parliament, for Hertfordshire (1868-74) and Stroud (1880-6), abandoning politics when he found it necessary to dissociate himself from his leader Gladstone on the home rule question. In 1895 he was appointed governor of New South Wales, but resigned before the regular term (five years) was complete, leaving Sydney on 5 March 1899. During his governorship the campaign for federation was in full swing and ultimately successful, and his sound constitutionalism and unobtrusive advice were all the more valuable because from first to last he kept within the narrow limits of his office. After his return to England he retired into private life, and died in London on 22 November 1906. (G.C.M.G., 1899.)

Hampton, John Stephen (1809-1869), born in 1809, entered the medical branch of the navy, and in 1843 visited Tasmania as surgeon-superintendent of the convict transport *Constant.* Returning to England, he commended himself to the colonial office by his handling of prisoners, especially 'Pentonville prisoners and exiles;' and, when in 1846 it became necessary to appoint a new comptroller-general of convicts to administer a new system in Tasmania, Hampton was the office's immediate choice. He was appointed on 25 May, and reached Hobart in the *Maitland* at the end of November. His administration was efficient, though in many ways cold-blooded. When in 1855 the Tasmanian legislative council opened an enquiry into the conduct of the convict department, Hampton refused to give evidence, on the ground that penal establishments were under Imperial, not local, control; in this contention he was supported by the then governor (Sir H. Young), the local supreme court, and the privy council. On 22 October 1861 he was appointed governor of Western Australia, and reached the colony at the end of February 1862. His administration there was harsh, and created much discontent among the free colonists; but his handling of the convicts was firm and successful, and his public works policy was of great and lasting value to the colony. In 1868, when transportation to Western Australia was abolished, Hampton retired from office, and died in England on 1 December 1869.

Hanson, Sir Richard Davies (1805-1876), born in London on 6 December 1805, educated at Melbourne in Cambridgeshire, and admitted an attorney in 1828, besides practising his profession reported for the *Globe* and *Morning Chronicle,* and lectured in favour of Gibbon Wakefield's colonization scheme for South Australia. In 1835 he was appointed assistant commissioner for an enquiry into crown lands and immigration in Canada; there he acted as private secretary to Lord Durham, and with Wakefield drew up the report that Charles Buller signed. In 1840 he migrated to Wellington in New Zealand, where he was crown prosecutor and edited the *New Zealand Colonist.* In 1846 he moved to Adelaide, secured a leading position at the bar, wrote for the *Register,* and in 1851 entered the legislative council; when his election was petitioned against for technical irregularities, Sir Henry Young made him advocate-general, and thus an ex officio member of the council. This appointment is notable because Hanson was a strong opponent of state aid to religion—which was Young's declared policy—and only accepted the post on condition that he remained free to continue his opposition. In the next few years he devised and carried several acts of high importance—in 1852 a district councils act on which all subsequent South Australian legislation of the kind is based, and an act for the abolition of grand juries that transformed the colony's criminal law (and incidentally angered Judge Boothby, q.v., beyond reason); in 1853 acts reforming the procedure of the supreme court, amending the law of trustees, and dealing with the registration of joint stock companies. The education act of 1851 and the bullion acts of 1852 owed much to his shaping, and the constitution act of 1856 was drafted by him. In the first ministry (Finniss's, of 1856-7) formed under responsible government he was attorney-general, and within six weeks of the defeat of that ministry formed one of his own which lasted until May 1860. During these terms of office he passed the first South Australian patents act, an act abolishing the public execution of criminals, and a bill (which the British authorities disallowed for many years) legalizing marriage with a deceased wife's sister. Though at first an opponent of Torrens's land-registration law, he worked hard to make it effective when once passed and suggested the appointment of Torrens himself to the headship of the registry office. From March 1857 to November 1861 he was one of the members for Adelaide in the legislative assembly; on the latter date he was made chief justice in succession to Sir Charles Cooper, again angering Judge Boothby beyond reason. As a judge he was insistent on the importance of first principles and perhaps over-impatient of technicalities, but few of his judgments were reversed on appeal. In 1869 he visited England and was knighted by Queen Victoria; in 1872-3 he was for six months administrator of the government; and in 1874 he was chosen to be chancellor of the newly founded university of Adelaide, but before he could deliver his inaugural address

died suddenly at Mount Lofty on 4 March 1876. Outside politics and the law his chief interest lay in theological studies, and he published three books that long remained textbooks of rationalism—*Law in Nature* (Adelaide, 1865), *The Jesus of History* (London, 1869), and *Paul and the Preaching of Christianity in the Primitive Church* (London, 1875). (Kt. Bach., 1869.)

Harbours may be classified as natural or artificial. The line of division, however, must necessarily be somewhat arbitrary, since the best natural harbour requires considerable engineering work to enable it to meet the needs of modern commerce, while most so-called artificial harbours have some feature, commercial or geographical, which make them specially suitable as ports of trade or refuge. In proportion to her coast-line Australia has comparatively few natural harbours of first-rate importance, and some of these are too remote from industrial centres to be much utilized. The most notable are:—

1. Port Jackson, one of the finest of natural harbours, since its shores are broken up by steep points that enclose bays which are harbours in themselves, usually with deep water close to the foreshores. Of these the best known is Sydney Cove (Circular Quay) in the heart of the city, used mainly for ferry traffic, though a few non-British mail-steamers still berth there. Walsh Bay, a shallow bight just west of the Cove, is provided with shed accommodation to suit the largest modern cargo vessels; and at Darling Harbour, the next deep bay westwards, are the wharves of the chief inter-State shipping companies, and the main wharves and warehouses connected with the railway system. Woolloomooloo Bay, east of the Cove, has large wharves and a broad central jetty to accommodate big cargo vessels; since 1924 the British mail-steamers have also berthed there. There are about ten miles of wharfage in all, and the chief wharves have from 28 to 40 feet of water. They are reached from the ocean by channels 700 feet wide with a minimum depth of 40 feet at low tide, one for incoming and one for outgoing vessels. Large dry docks at Cockatoo Island, a few miles west of the Cove, belong to the Commonwealth; the largest is 608 by 84 feet with a depth of 32 feet. There are also privately owned docks at Woolwich on the north and Balmain on the south of the Parramatta, of which the former is 765 by 83 feet and 28 feet deep. All these are connected with workshops capable of carrying out repairs to the largest visiting steamships. In 1922-3 8,813,432 tons of shipping entered Port Jackson.

2. Jervis Bay, 82 miles S. of Sydney. On its southern side is an area of Federal territory containing a naval station and the naval college. It extends 8 miles N. and S. and 3 to 5½ miles E. and W., with depths varying from 18 fathoms at the entrance to 6 fathoms within half a mile of the greater portion of its shore. As with the next-mentioned harbour, its connections with the inland districts are as yet too incomplete to permit proper development of its facilities.

3. Port Stephens, 83 miles N. of Sydney and 20 miles N. of Newcastle, a fine harbour whose entrance has a depth of six fathoms (with a small patch of five fathoms at outer end); a large area of the harbour has a depth of six to eight fathoms.

4. Twofold Bay, 208 miles S. of Sydney, situated near the southern boundary of New South Wales. This port is at present suitable as a refuge for vessels of 26 feet draught in southerly weather, but is open to the eastward. It could be made a safe harbour in all weathers by the construction of a breakwater from the southern side in a northerly direction; vessels drawing 30 feet could then be accommodated with a good anchorage, and loading facilities.

5. Port Phillip, which has an area of 31 by 20 miles, with a western arm, Corio Bay, on which stands Geelong. The entrance of the main bay has 36 to 40 feet of water, but with an ebb-tide and southerly wind carries a dangerous 'rip,' caused by a belt of rock with deep water on both sides. There are two main channels, of which the southern is being dredged to 36 feet. The port is in Hobson's Bay, at the northern end of the great bay: the principal accommodation was originally at Sandridge (now Port Melbourne), but since the dredging of the Yarra and the cutting of the Coode Canal the longer wharfage is on the Yarra. Port Melbourne has 8460 feet of wharfage, with 26 to 32 feet depth, utilized generally by mail steamers; Williamstown has 6600 feet, with 17 to 30 feet depth, utilized by oversea cargo vessels; on the Yarra there are 30,450 feet, with 17 to 26 feet depth, utilized chiefly by inter-State steamers—this area includes the Victoria Dock, 96 acres in extent. There is a dry dock at Williamstown and two others on the Yarra, of which the larger is 480 by 50 feet, besides patent slips and floating-docks with their attendant workshops. In 1922-3 7,015,030 tons of shipping entered Port Phillip; but this total is swelled abnormally because, Sydney being the terminus of many oversea lines, their vessels enter Port Phillip twice on each voyage. Geelong is credited with an entering tonnage of 553,689 (1922-3).

6. Western Port, 26 miles SE. from Port Phillip, with an entrance 3½ miles wide and a depth of 12 to 15 fathoms in mid-channel. The harbour is 20 square miles in extent, with a depth of four to eight fathoms. A naval base has been established on the western side.

7. Port Lincoln, near the SW. extremity of Spencer Gulf, with an extent of six by three miles and a depth of five to nine fathoms, and almost landlocked. The principal jetty is 660 feet long. The port is the terminus of the Eyre Peninsula railway, with a rich wheat-growing district at its back. At Cape Thevenard a pier has been built to accommodate oversea wheat ships.

8. Wallaroo on the E. coast of Spencer Gulf, connected with Adelaide by rail. The single jetty is 2820 feet long, with 25 feet of water alongside. In 1922-3 233,046 tons of shipping entered Wallaroo.

9. Hobart, a magnificent harbour, 12 by 2½ miles in extent, with deep water close to the shore. It has 8500 feet of wharfage, with a depth of 26 to 58 feet at low water, besides accommodation for smaller vessels. There is a large export trade in apples, hops, timber and wool; formerly whale oil was exported. In 1922-3 589,248 tons of shipping entered Hobart.

10. Port Arthur on Tasman's Peninsula, of historic but little commercial importance; it is one of the most secure of natural harbours, extending five miles, with 22 fathoms of water in the centre and six fathoms close to the shore. Its lack of communications with any area that could supply trade makes it practically useless.

11. Macquarie Harbour, on the W. coast of Tasmania, with an area of 112 square miles and

depths ranging from 5 to 20 fathoms. The narrow entrance is dredged to 16 feet. Strahan, at its northern end (which is connected by rail with Burnie on the N. coast), has 1000 feet of wharfage with depths of 13 to 18 feet. Kelly's Basin on the SE. shore has 600 feet of wharfage with 12 to 20 feet of depth.

12. Albany (Princess Royal Harbour), which forms the inner portion of King George's Sound, a fine natural harbour (the entrance, about a quarter of a mile wide, has 33 feet of water), connected by railway with Perth. The oversea jetty has 3000 feet of wharfage in 30 feet depth; the coastal steamers' jetty, 2744 feet long, has ample accommodation in 14 to 23 feet of water. In 1922-3 720,007 tons of shipping entered Albany.

13. Derby, at the head of King Sound in Western Australia, near the entrance to the Fitzroy River; it is the port of shipment for live-stock from the rich Kimberley district. The mouth of King Sound (60 miles from Derby) is studded with islands; between them are three passes, through which rush strong tides; the tidal rise is 24 to 30 feet.

14. Port Denison, on which Bowen stands, one of the finest but least used of Queensland harbours, with an entrance depth of 18 feet at low water, and a spring rise of 10 feet. There is ample wharfage, with 23 feet at low tide. In 1922-3 487,454 tons of shipping entered Port Denison.

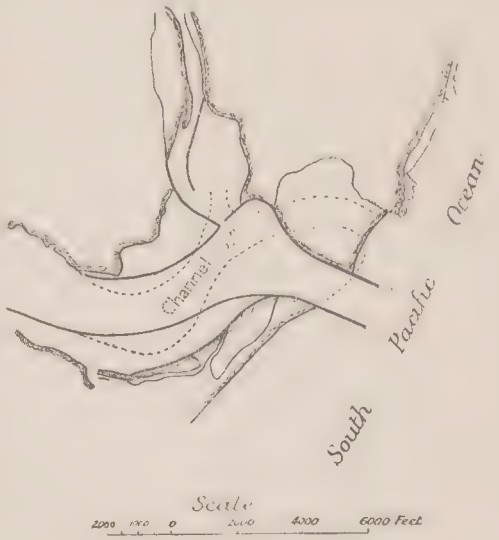
15. Cairns on Trinity Bay, 990 miles NW. of Brisbane, the outlet for a rich sugar, timber, and mineral region. The entrance is dredged to 20 feet at low water (spring rise nine feet). Some 1500 feet of wharfage in 18 to 24 feet of water is connected with the railway. In 1922-3 570,703 tons of shipping entered Cairns.

16. Port Curtis, on which Gladstone stands, a fine harbour with a good oversea trade in frozen and preserved meats. It was for many years the port for transhipment of mails for northern Queensland.

17. Port Darwin, the chief port of the Northern Territory, terminus of the cables of Java, and a port of call for Eastern trade liners. The harbour has 7 to 14 fathoms of water; the jetty, 528 feet long with 22 feet at low water (spring rise 22 feet), is connected with the town by tramway. In 1922-3 99,955 tons of shipping entered Port Darwin.

It will thus be seen that the whole Australian coast-line—over 12,000 miles long—affords at most 17 good natural harbours within anything like convenient distance of the productive country inland. The construction of artificial harbours, often at very great expense, has therefore become a necessity of the situation. These may be divided into two classes—river ports, dependent on training walls and entrance moles, and roadstead ports, in which the natural protection of a headland is augmented by the construction of breakwaters.

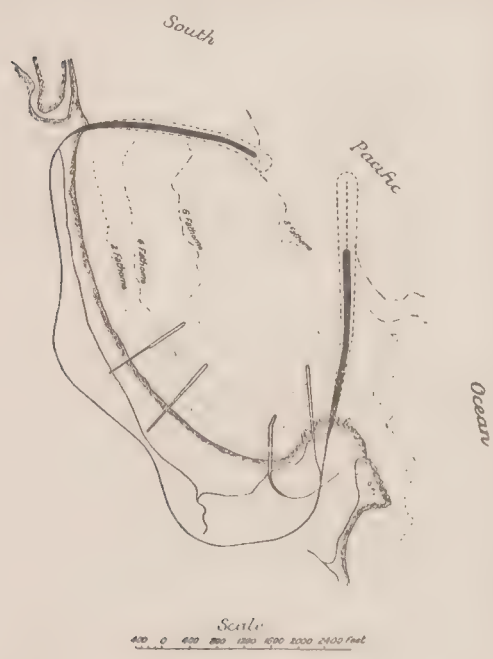
New South Wales. A typical river port has been made at the Richmond River in northern New South Wales. The main difficulty in its construction was to fix the position of the main channel, and especially of the entrance, so that it should be maintained by the tidal currents and not altered or damaged by the not infrequent floods of the river and its principal tributaries. Before the improvement works were started, the position of the entrance had varied within a range of 1¼ miles; on four occasions at least floods broke through the southern sand-spit, and the mouth thus formed became the entrance for shipping. This new channel would gradually work northwards, owing to the action of southerly winds, until it again reached the northern headland. Further, the shifting nature of the sandbars at the river-mouth made navi-



Richmond River port.

gation at all times dangerous, and sometimes impossible for months at a time. The Richmond River is a highway to one of the richest agricultural districts in Australia, with a 62-mile channel to Lismore navigable for steamers with a depth of 12 feet. The chief obstacles to the permanence of these river ports are currents, winds, and floods. Along the New South Wales coast the East Australian current (see CURRENTS) creates an eddy, usually weak, alongshore in the opposite direction; when backed by heavy winds from the south, this return-current gathers great strength and often moves large masses of sand athwart the river entrances. Harbour engineers dread an on-shore gale, as heavy seas accelerated by such a gale greatly increase the sand-barrier at these entrances, and may interfere with (or even prevent) the entrance or exit of shipping. On the New South Wales coast the heavy seas due to south-west and south-east winds do less damage than those raised by direct on-shore (easterly) gales. The mileage of S. winds—according to G. H. Halligan, F.G.S.—is 30,567 miles, against 14,898 miles of NE. winds; but, taking into account only winds of more than 30 miles per hour, the proportion of S. to N. winds (after discarding off-shore winds) is as 36.2 to 1.2. Any effect therefore, of heavy winds along this coast on the direction of littoral drift must be from S. to N. The discharge of upland water must also be considered in designing river entrances. This both effects a scour additional to that produced by tidal action, and is an important factor in deciding how much width shall be left between breakwaters. Where little upland water is available to assist the ebb-tide scour, the tendency is for the entrance to close. If insufficient provision is made for discharge, the flood creates a deep gorge which endangers the safety of the training-walls and breakwaters. A typical roadstead port is found at Port Kembla (45 miles S. of Sydney), the main port of the southern

coal-fields of New South Wales. It is naturally protected by a southern headland, and at first only one—the eastern—breakwater was proposed, 2750 feet long; with the growth of trade, how-



Port Kembla.

ever, it was decided to construct a northern wall, and to create a practically still-water port. Stones of not less than four tons weight were used in the eastern wall, which was faced on the ocean side with blocks of 20 tons and upwards. This breakwater is now being extended 1000 feet. Some difficulty was experienced with the railroad on the top of the wall, as heavy seas tore out the ballast on which the lines were laid and shifted the rails and sleepers out of position. To overcome this difficulty, all packing material above the large stones was replaced by concrete, the sleepers being embedded in the surface concrete, and the railroad was anchored to old rails set in the concrete at a lower level. This method has given great satisfaction. The northern breakwater is constructed of stones not less than three tons in weight, and is protected on its outer slope by heavier blocks. There is still some range of sea at times within the port, but delays from this cause in shipping are now unknown, and loading is carried on when stand-off signals are being displayed at adjacent ports. The area enclosed is 334 acres, as compared with harbours at Dover, 600 acres; Colombo, 500 acres; Chicago, 455 acres; Holyhead, 400 acres; Barcelona, 380 acres; Ymuiden, 250 acres; Kingston, 250 acres; Tynemouth, 240 acres; Madras, 220 acres; Algiers, 220 acres. The depth of water is ample for the largest ships afloat, although the present wharfage will not serve vessels of greater draught than 30 feet.

At Newcastle, the chief coaling port of Australia, the Hunter River has its exit between breakwaters. There are three miles of wharves, and an inner basin about 5000 feet long by 1000 feet wide is now being dredged. The harbour has depths from 23 to 30 feet at low water. The wharves are provided with hydraulic and electric cranes, capable of loading coal at 200 tons per hour. The steel works of the Broken Hill Co. at Port Waratah, large smelting works and the state ship-building yards at Walsh Island have added to the importance of this port. The construction of a large floating dock has been authorized, but the work has not yet been commenced. In 1922-3 4,662,155 tons of shipping entered Newcastle. Among the other New South Wales rivers whose estuaries have been improved is the Clarence River. The entrance is protected by training-walls; the main channel is navigable for vessels of 13 feet draught to Grafton (40 miles); the minimum depth on the bar channel is 12 feet 6 inches. Breakwaters have been built at Cape Hawke, at the entrances of the Manning, Bellinger, and Tweed rivers (the last of which is connected by railway with Brisbane), and at Moruya (180 miles S. of Sydney). At the Nambucca River and at Camden Haven training-walls have been constructed. T.E.B.

Victoria. At Warrnambool in Victoria protection from southerly winds is given by a curved breakwater-pier 1000 feet in length, built of concrete blocks; the western side is covered by a series of islands and rocks. There is a depth of 15 feet alongside the pier. The exports are potatoes, wool and agricultural products. Port Fairy (Belfast), at the entrance of the Moyne River, has two stone training-walls 1500 feet long.

South Australia. Port Adelaide, the third port of Australia, is situated eight miles up the winding river Torrens, but only about two miles in a direct line from the coast. The river is being dredged to a minimum depth of 27 feet, with a width of 250 feet. There are four miles of wharves, with a depth of 16 to 27 feet, and it is proposed to construct six large wet docks for vessels handling cargo. An outer harbour for ocean steamers has been constructed on the shores of St. Vincent Gulf; it has 2400 feet of wharfage with a depth of 33 feet at low water, and one berth, 600 feet long, with a 36 feet depth. In 1922-3 4,065,796 tons of shipping entered Port Adelaide. Port Pirie on the E. side of Spencer Gulf is the port of shipment for Broken Hill ore, and the site of large smelting works. It contains about 6000 feet of wharves situated five miles from the entrance, and is connected with Broken Hill and Adelaide by railway. The channel is 250 feet wide and 18 feet deep, the spring rise being 10 feet. In the harbour there is a swinging basin 1000 by 600 feet. In 1922-3 646,288 tons of shipping entered Port Pirie. Port Augusta, at the head of Spencer Gulf, is the eastern terminus of the federal trans-continental railway, which here makes connection with the State railways of South Australia. The entrance channel for eight miles has a minimum breadth of 200 feet with 18 feet depth at low water; the spring rise is 12 feet. The wharves are 1188 feet long, with a depth of 22 feet.

Tasmania. Launceston on the Tamar, some 42 miles from its mouth, is the second port of Tasmania. There is a minimum depth of 21 feet in the channel, and 3200 feet of wharfage with 16 to 20 feet depth at low water, and a spring rise of 12 feet. In 1922-3 382,315 tons of shipping entered Launceston. Beauty Point is a deep-water (40 feet) port six miles inside the Tamar entrance, and it is proposed to construct another at Ball Bay (7½ miles

from the entrance) in 42 feet of water. Devonport at the mouth of the Mersey has a training-wall 1000 yards long from the E. shore, and a short one on the W. side linking up a group of rocks. A bar of shingle at the mouth has been dredged to a depth of 20 feet at low water; the spring rise is nine feet. Limestone bins here can load at the rate of 1200 tons per hour. There is 1700 feet of wharfage in 14 to 20 feet of water. In 1922-3 359,317 tons of shipping entered Devonport. Burnie on Emu Bay is protected by a concrete breakwater wharf, 1250 feet long, with 40 feet of water at its outer end. There is a wooden pier 600 feet long, where vessels can discharge into railway trucks. Extensions to breakwaters and wharves will provide 3000 feet of wharfage. There are large exports of minerals, especially tin and copper. In 1922-3 461,697 tons of shipping entered Burnie. Stanley is situated on a deep bay protected on the N. and W. by Circular Head. A massive breakwater 700 feet long protects its inner harbour; on the W. the breakwater pier is 551 feet long, with a depth of 15 to 34 feet, besides accommodation for smaller vessels.

Western Australia. Fremantle at the mouth of the Swan River, the chief port of Western Australia, is entirely artificial. It was formed by blasting away a bar that formerly obstructed the entrance, and is protected by a massive breakwater. The harbour is about 1 mile long by 1000 feet wide, with a present depth of 30 feet, which is to be further dredged to 36 feet. About two miles of wharfage is connected with the railway and lighted by electricity; travelling electric cranes facilitate the working of cargo and coal. In 1922-3 2,664,643 tons of shipping entered Fremantle. Slightly to the S. is the site for the proposed Cockburn Sound naval base, a natural harbour sheltered by islands and reefs. Wyndham, the most northerly port in the State, lies up the Ord River 54 miles from Cambridge Gulf. Vessels lie aground on mud at low water. The spring rise is 18 to 24 feet, and the velocity of the ebb-tide seven to nine knots. The exports are cattle and frozen meat. Bunbury is a roadstead protected from the W. by a massive stone breakwater 5015 feet long. There is a wharf 1950 feet long, with berths on each side—the outer 400 feet in 26 feet of water. An extension of this will give 552 feet more length and 22 feet more width, with a depth of 30 feet. The chief export is jarrah timber. In 1922-3 306,891 tons of shipping entered Bunbury.

Queensland. Brisbane, the chief port and capital of Queensland, lies on the Brisbane River, 17 miles from Moreton Bay. The bay is full of sandbanks, through which two main channels have been marked by buoys and leading lights; the very winding river has a channel 400 feet wide, with a minimum depth of 24 feet (now being dredged to 26 feet), and a spring tide of seven feet. Mail steamers use the wharf at Pinkenba, eight miles below the city; at Brisbane itself there is some 14,000 feet of accommodation, with depth up to 28 feet, and a dry dock (430 by 50 feet 4 inches) with 18 feet of depth at high water. In 1922-3 3,121,839 tons of shipping entered Brisbane. At Maryborough on the Mary River, 20 miles from the entrance, there is 1500 feet of wharfage, with 14 to 21 feet of depth; this port is used for inter-State and coastal trade only, the navigation of the river being intricate. The port of Rockhampton on the Fitzroy River, 38 miles above its mouth in Keppel Bay, can be reached only by vessels of moderate draft. Port Alma, at the mouth, is the deep-water berth for this port; it has 1000 feet of wharfage with 25 feet depth at low water, and a spring rise of 13 to 16 feet. In 1922-3 497,388 tons of shipping entered Rockhampton. At Townsville on Cleveland Bay, the chief town of northern Queensland, the roadstead is protected by breakwaters, of which the southern contains 2200 feet of wharfage with 23 to 27 feet depth; there is also a concrete jetty 940 feet long, with 25 feet depth. The spring rise is 8 to 12 feet. In 1922-3 1,172,515 tons of shipping entered Townsville.

Many small ports are available for coastal trade only. Among these are in New South Wales Port Macquarie, Byron Bay and Catherine Hill Bay N. of Sydney, and Bulli, Tathra (the port for Bega), Merimbula and Nelligen S. of Sydney; in Victoria the historic Portland with its rich hinterland, but precarious anchorage; in South Australia the wheat ports on Spencer Gulf (Broughton, Port Germein and Franklin Harbour), and Edithburg in St. Vincent Gulf, backed by the chief salt-producing district in Australia; in Tasmania several ports on the Huon River and D'Entrecasteaux Channel for the trade in fruit, timber and agricultural produce; in Western Australia Geraldton, Carnarvon (Gascoyne River), Onslow, Broome and Port Hedland—the last a landlocked harbour with narrow entrance and strong tide; and in Queensland Mackay, Bundaberg, Lucinda Point, Cooktown (Endeavour River), and Normanton on the Norman River, 55 miles above its entrance into the Gulf of Carpentaria. J.Cr.

Hardhead. See DUCKS AND GEESE.

Hare's-foot Fern. See FERNS.

Hare-wallaby, the popular name for three species of the genus *Lagorchestes* and family Macropodidae. All the species are confined to the Australian mainland. The Common Hare-wallaby (*L. leporoides*), of the interior of New South Wales and South Australia, is hare-like in size and in the general appearance of its fur, but resembles its allies the wallabies in the special modification of its limbs. It is fairly abundant in open country in the interior. In Western Australia its place is taken by the Rufous Hare-wallaby (*L. hirsutus*), distinguished by the presence of a rich rufous patch on the rump; and in the north of Australia generally, as well as in certain of the islands off the north-western coast, there occurs a third species, the Spectacled Hare-wallaby (*L. conspicillatus*), so named on account of a band of chestnut surrounding the eye. See MARSUPIALS. W.A.H.

Hargrave, JOHN FLETCHER (1815-1885), born at Greenwich near London on 28 December 1815, and educated at the university of London (where he became a friend of Dr. Woolley) and at Trinity College, Cambridge (B.A., 1837; M.A., 1840), was called to the bar from Lincoln's Inn in 1841 and immediately began to establish a reputation as writer of textbooks. He practised at the equity bar until 1856, in which year he migrated to Australia, and soon afterwards was made a district court judge. In February 1859 he resigned this position and entered politics, becoming solicitor-general in the second Cowper ministry on 21 February 1859, retaining the post in the Forster ministry of 1859-60, taking the attorney-generalship in the Robertson-Cowper ministries of 1860-3, and towards the close of that period reverting to his

old post of solicitor-general, which he also held in the fourth (1865) Cowper ministry. On 22 June 1865 he left politics to become a puisne judge of the New South Wales supreme court, and held that position until 11 October 1881, when he retired on a pension. During his political career he was at first a member of the assembly, representing East Camden in March and April 1859, and Illawarra from June to October; on 10 October 1859 he was nominated to the legislative council, and renominated in June 1861, when the first appointment terminated. He died on 23 February 1885. His work in the council included the carrying through of several important pieces of legislation—an insolvency act, among others, and an act for abolishing state aid to religion; his assumption of the attorney-generalship was intended to give him greater authority while piloting John Robertson's land bills through the council. From 1858 to 1865 he was reader in general jurisprudence at the university of Sydney. While on the bench of the supreme court he was primary judge in equity and (later) first judge of the divorce court.

Hargrave, LAWRENCE (1850-1915), born in England in 1850, was the son of J. F. Hargrave mentioned above. When his father migrated to Australia in 1856, Lawrence was left in England to continue his education, but came out in 1866, was apprenticed to an engineering firm, and was afterwards an assistant at the Sydney observatory. During his work there his attention was directed to the study of air currents; this led him to consider the problems connected with flight, especially human flight, and the solution of these problems became his life's work. In 1884-92 he experimented with monoplane models constructed of a framework of light wood and tissue-paper, the earliest of which were propelled by means of flapping wings, the later ones by a screw. The motive power was, first, clockwork, then rubber-bands in tension, then compressed air, and lastly steam. With these models flights of between 300 and 400 feet were repeatedly made in a horizontal course, but they could neither rise from the ground nor steer to right or left; and the most important result of these achievements was probably the world-wide stimulus they gave to the study of aerodynamics. The compressed air and steam engines designed to drive the models were extremely simple and light, yet marvels of ingenuity. These alone were sufficient to stamp Hargrave as an exceptionally resourceful engineer.

Prominent amongst his discoveries at this time was that of the rotary aeroplane-engine, made in 1889. To quote his own words, 'The idea was conceived that a three-cylinder screw engine could be made by turning the boss of the propeller into an engine, thus allowing the cylinders to revolve on the crank-shaft, the shaft and crank-pin being stationary and the thrust coming direct on the valve-face.' His engine designed on these lines weighed only 7½ ounces, and made 456 revolutions per minute. Rotary engines based on this design have proved peculiarly adapted to aeroplane work, for a fly-wheel effect is obtained which increases the smoothness of running. The celebrated French Gnome, the Clerget and Le Rhone are modern engines constructed on this principle.

The two halves of the body-plane of Hargrave's monoplanes were composed of flat surfaces, continuous in the early models, but set at a dihedral angle in the later. In 1892 he began to experiment with curved surfaces. The increased lift obtained with these opened up a new and larger field for research, and resulted in the production of cellular kites, upon which Hargrave's place in aeronautical history chiefly rests. The most efficient kite constructed in 1893 had two rectangular cells, separated at a distance of 21.25 inches fore and aft by a wooden rod. It was experimentally proved that such a kite, with the upper and lower surfaces curved (convex above and concave below), exerted twice the lift of one in which they were flat. In 1894 by means of four kites weighing 34lb. 13oz., he succeeded in raising a weight of 208lb. a distance of 16 feet from the ground in a 21-miles-per-hour wind. The kites employed for this experiment were, owing to the difficulty then experienced of making the curves sufficiently rigid, composed entirely of plane surfaces, otherwise a much greater lift would have been obtained. Much time was now devoted to designing kites that would soar in a horizontal wind, and in 1897 Hargrave succeeded in flying a kite which soared 20° to windward of the zenith in a 12- or 14-miles-per-hour breeze. Hargrave's kites proved to be of epoch-making importance. They possessed far greater lift and stability than any apparatus previously discovered, and paved the way for the successful heavier-than-air flying machine. The first aeroplane that ever flew publicly, that of Santos-Dumont in France in 1906, was simply an arrangement of the Hargrave box-kite. The original models of his monoplanes, and one box kite, are now in the Sydney technological museum; all the other inventions, including the other box kites, are in the Munich museum in Germany.

The results of Hargrave's experiments were published in the *Proceedings* of the Royal Society of New South Wales as soon as they were made. He resolutely refused to patent any of his inventions, but devoted his life to the study of aeronautics for pure love of science and the progress of civilization. Towards the end of his life he took up the study of early Australian exploration, and made public some deductions from personal observation that failed to secure approval from more expert historians. It was, unfortunately, through these published views that many Australians knew him, and his real contributions to science—which were of very great value, and brought him the admiration and the thanks of the greatest pioneer aviators—remained obscure outside scientific circles. He died at Sydney on 6 July 1915.

See AVIATION, plates vii and viii and T. C. Roughley's *Lawrence Hargrave, Australia's Pioneer in Aviation,* (in *Technical Gazette of N.S.W.,* 1923-4). T.C.R.

Hargraves, EDWARD HAMMOND (1816-1891), born at Gosport in England on 7 October 1816 and privately educated at Brighton and Lewes, entered the merchant service in 1830, reached Port Jackson in 1832 and, after a few months on a station, joined the crew of a French fishing schooner to get bêche-de-mer and tortoise-shell in Torres Straits. All but seven of the crew died of typhus fever at Batavia; Hargraves, taken back to England, returned to Australia in 1834 and for the next 14 years followed pastoral pursuits, traversing a good deal of the western foothill district of New South Wales, holding a station on the Manning, and making his home at first in Illawarra (1836-41) and then at Gosford on Brisbane Water (1841-9). On 6 July 1849, disgusted with poor returns from cattle-

sales, he sailed for the Californian gold-diggings, where he had fair success at the Wood's Creek field in the Stanislaus valley. While there he repeatedly assured friends that he knew places in New South Wales of exactly the same kind, where gold must be found sooner or later; and as soon as he had gained enough to recompense him for the double trans-Pacific journey he went back to New South Wales, reached Sydney on 7 January 1851, made up-country (without even going home to Gosford) for the rough valleys beyond Bathurst that he had in mind, picked up at Guyong a young bushman, John Lister, and with him on 12 February washed the first pan of gold-bearing gravel at the junction of the Summerhill and Lewis Ponds creeks. Confirming this discovery by further samplings of creek-gravel over an area of 70 by 40 miles in the Macquarie valley—during which James Tom acted as his and Lister's guide—he hastened back to Sydney to bargain with the authorities for £500 before he disclosed the auriferous localities. Deas Thomson, however, insisted that he must trust the government's generosity. He agreed to do so, named the localities, and within three months 400 diggers were camped at Ophir (the scene of the first discovery), while others were prospecting the neighbouring valleys. The £500 was duly paid over to him in June.

The story of the later discoveries is told under GOLD, DISCOVERY OF. Hargraves's part in it was not great. He was appointed commissioner of crown lands, and in October 1853 was granted a sum of £10,000 by the New South Wales legislature; the Victorian legislature—partly because Victoria was in February 1851 part of New South Wales, partly because it was his discovery that stimulated the search for gold in the Port Phillip district—voted him £5000 but in the end paid him only £2381. In 1854 he visited England, was presented to Queen Victoria, and in the next year published *Australia and Its Goldfields*. In 1862 he visited Western Australia at the request of the government, but after six months' labour failed to find any gold, and reported that the colony was non-auriferous but rich in copper, lead and iron. In those days, it must be remembered, the colony was a mere strip on the south-western corner of the continent, and Hargraves never had a chance of investigating the inland plains where great deposits of gold have since been found. In 1864 he was equally unsuccessful in Tasmania. The rest of his life was uneventful. In 1877 the New South Wales legislature added to its previous grants an annuity of £250 for life. He died at Forest Lodge, a Sydney suburb, on 29 October 1891.

His claim to be the first discoverer of gold in Australia has been frequently contested from two standpoints. It is contended—quite accurately—that several predecessors had found gold in New South Wales, notably Strzelecki (q.v.) in 1839 and W. B. Clarke (q.v.) in 1841-2. In those days the colony was still a convict settlement, and knowledge of the discoveries was carefully suppressed by high officials; there is no reason to suppose that Hargraves knew of them. It does not in the least detract from his merit to admit that, scientifically speaking, he had predecessors, nor from theirs to admit that, partly because there was no further need for suppression, he was the first to make a practically useful discovery. On the other hand, representatives of Lister have contended that he took Hargraves to the fateful spot, and the Toms claimed that they were the first to get gold in payable quantities. Hargraves from the first denied both these allegations, and it is impossible to procure any other first-hand evidence on the subject. It is, however, indisputable that Hargraves drew conclusions from his own experience, returned to Australia from California specially in order to look for gold where he expected to find it, found it in the district—if not in the exact spot—where he intended to look for it, taught Lister and the Toms how to wash gravel, and was the effective cause of the subsequent goldrush. ('Had I known' said Charles Blakefield to W. B. Clarke in 1852, 'that the whole science of gold-washing lay in the shaking of a tin dish,' the rush would have occurred in 1843.) There is no need to claim anything more for him; but that claim is enough for his enduring fame.

Harlequin Fish. See ROCK COD.

Harpullia, a small genus of the family Sapindaceae, with several species in tropical Asia and Madagascar, and 5 endemic in Australia—mostly in the eastern States. *H. pendula* (Tulipwood) is a medium-sized tree of the coastal brush forests ranging from northern New South Wales to Queensland. It has a handsome timber, nicely marked and shading from yellow to black, which has been used in making billiard tables and other furniture. It is tough and durable, resembling olive-wood, and is said to be our best timber for lithographic scrapers.

Harpur, CHARLES (1813-1868), born at Windsor on the Hawkesbury on 23 January 1813, spent most of his early years in the bush, but was for a short time accountant in the Sydney post-office and so had an opportunity of meeting the few literary men of those days. In 1843 he took up farming on the Hunter River, and from 1850 onwards owned a small sheep-station; but by 1858 he was glad to accept from Sir John Robertson the post of gold commissioner at Araluen. Concurrently with this work he farmed land at Eurobodalla, but unsuccessfully; in 1866 his commissionership was abolished, in 1867 he lost his second son by a gun-accident, and during the winter of that year his farm was almost destroyed by floods. Sinking beneath these misfortunes, he died on 10 June 1868.

Harpur was the first Australian-born poet to deserve more than the meagrest of mentions. A slow writer, and dominated (like all his contemporaries) by the traditional phraseology of English verse, he wrote little that is worth study except in blank verse; but his 'Creek of the Four Graves' will always be remembered as the first good verse directly inspired by and depicting life in the Australian bush. In 1845 he published a small book of sonnets, in 1853 a play and a few poems, and two more volumes in 1862 and 1865; but his verse was first collected and given an attractive form in 1883. Probably the best eulogy of him lies in the statement that he inspired Kendall both to a closer study of bush life and to a fine threnody.

Harrier. See HAWKS.

Harris, JOHN (1754-1838), born at Magherafelt in county Londonderry, Ireland, in 1754 and trained for the medical profession at the university at Edinburgh, served as a surgeon in the navy for ten years in East Indian waters, and in 1789 was appointed surgeon mate of the New South Wales Corps. The original corps surgeon, James Maccauley, resigned his post before the corps left England, and Harris was practically surgeon from the time of his embarkation for

the colony, although he did not obtain the substantive rank until 1792. He reached New South Wales in the *Surprize* on 26 June 1790, and was posted at Parramatta: on 1 April 1793 Grose gave him 100 acres at Parramatta, and on the 18th he bought from James Ruse (q.v.) the farm afterwards called Experiment Farm. The Parramatta grant being needed for public purposes, a fresh grant of 110 acres at Rose Hill was made to him on 20 February 1794, and this, with the adjoining Ruse grant, became the estate since known as Harris Park. In 1800 he was made a magistrate, and in 1802 succeeded William Balmain as 'naval officer'—i.e. officer controlling the port of Sydney: in the same year he was put in charge of the police, and King reported that he was performing all his duties 'to the evident public benefit and conspicuous general good of His Majesty's service without neglecting an hour's duty as surgeon of the corps.' King might have added exploration to his other tasks, for in 1801 Harris accompanied Grant in the *Lady Nelson* to the Hunter River and took part in the exploration of its valley far beyond Maitland. He earned, however, as port officer a good deal of unpopularity by aiding King to suppress the liquor traffic, and in October 1802 was court-martialled on charges brought against him by his commanding officer in the corps (Paterson), but was unanimously and honourably acquitted. In 1803 King, knowing that he had occasionally acted as deputy judge advocate, made him prosecutor at the trial of Captain Kemp: Johnston, who was commanding during Paterson's illness, promptly put Harris under arrest again, and a long dispute followed. Meanwhile King had reinstated Harris in the positions (magistrate, naval officer, and head of the police) from which his first court-martialling had automatically removed him, but Harris accepted the magistracy only: still, in 1804 King again eulogized his services, particularly mentioning his share in the building of the cutter *Integrity* (see SHIPBUILDING), and in March of that year persuaded him to act as naval officer during the absence of the new appointee. Bligh in April 1807 dismissed him from that post and even from the magistracy, probably for the mere reason that he was an officer of the hated corps: but Harris, in letters to his old friend King and Mrs. King that throw a great deal of light on Bligh's unpopularity (they are given in *H.R.N.S.W.*, vi. 336-49), says that he resigned the post of naval officer and Bligh, 'to be revenged,' dismissed him from the magistracy.

On 27 January 1808, immediately after the mutiny against Bligh, Johnston reinstated Harris as a magistrate, but in April, finding that he and Macarthur were at odds, dismissed him again. After a curiously acrimonious correspondence in which Harris hinted that he knew a good deal more than Johnston about the causes of the mutiny, he was sent to England as a witness for the mutineers: but it is noteworthy that a petition of 30 June to Colonel Paterson, signed by anti-Johnston settlers, specifically expresses confidence in Harris and asks for his retention in office. Paterson accordingly objected to letting Harris go, but Johnston insisted, and he left Sydney in the *Admiral Gambier* along with Johnston himself, Macarthur, and Dr. Jamison (a most incongruous collection) on 28 March 1809. On the way home the vessel put in at Cape Town, and Harris made the acquaintance of the Macquaries, who were on their way out in the *Hindostan*: the impression he made on Mrs. Macquarie was not favourable, and probably accounts for certain occurrences in later years.

While in England Harris retired from the corps, and in 1813 petitioned the colonial office for leave to return to New South Wales as a free settler. Reaching Sydney again early in 1814, he settled down as a landowner and took very little interest in politics thenceforth, except in so far as he sided with Ellis Bent and his friends against Macquarie's encouragement of emancipists. In 1817 he helped to found the Bank of New South Wales, of which he was one of the first directors. In 1818, at the age of 64, he volunteered his services as surgeon for the famous and arduous expedition in which Oxley discovered the Liverpool Plains and Port Macquarie. In June 1819 Macquarie made him once more a magistrate, but in the following February charged him with grave disrespect. As magistrate he sat with Judge Field in the supreme court. In Brisbane's time he was involved in that governor's disputes with Samuel Marsden, but merely as an over-severe magistrate. Darling he supported against Wentworth, as became a large landed proprietor. He died on 27 April 1838.

Harris was, as King found, versatile and hard-working: he was also a man of very wide interests. He managed vigorously a large estate—besides the Harris Park land already mentioned King gave him 750 acres, and by 1807 Johnston, Marsden, and Harris were the three biggest landowners in the colony after Macarthur. Macquarie, too, during that moment of favour in 1819 granted him another 1100 acres near Bathurst. He was especially proud of his herd of spotted deer (chital) from southern India, which was unfortunately dispersed during his absence in England in 1809-12. In the *Lady Nelson* (1801) trip he was particularly active and adventurous. He had an affection for the name 'John;' he named his Parramatta estate 'Shane's Park' because Shane is the Celtic form of John, and in his will ordered that it should descend only to heirs of that name. His Sydney house—Ultimo House—got its name not (as many people have believed from his day until now) because it was, when built, the last house in Sydney, but because an official at one of his courts martial used the word *ultimo* ignorantly for *proximo* (according to Mrs. Macquarie, for 'instant'): this tickled Harris's fancy, and he wrote a satirical poem on the mistake and afterwards named the house 'Ultimo Place.'

Harrison, JAMES (1815-1893), born at Renton in Dumbartonshire, Scotland, in 1815 and apprenticed as a boy to a printer in Glasgow, was in 1837 sent out to Sydney from London in charge of some printing material consigned to James Tegg, a Sydney bookseller, for use in producing the *Literary News*—a magazine edited by William à Beckett (q.v.). To this magazine Harrison contributed, working also on the staffs of the *Monitor* and *Sydney Herald*. In 1839 he moved to Melbourne and joined Fawkner on the *Port Phillip Patriot*, but the next year was sent to Geelong to edit another of Fawkner's papers, the weekly *Geelong Advertiser*, the first issue of which was published on 21 November 1840. In 1842 Harrison bought Fawkner out, and in the following year began to issue the paper twice (and not long afterwards three times) a week. In 1851 he also published a few numbers of a literary quarterly, *The Australian*. During his ownership of the *Advertiser* he represented Geelong in the Victorian legislature from 1856 to 1861. About 1852 he began to study closely the

formation of ice by the evaporation of ether, and in 1856 and 1857 patented his process, which T. B. Lightfoot describes as 'much more complete and practical' than the contemporary and similar American process. At Rodey Point on the Barwon he built the first ice factory in Australia, but found that ice-making machinery on a commercial scale was unobtainable in Melbourne or Sydney, and went to London to exploit his invention. Scientific and business men in several European capitals approved of his patents, but were not prepared to pay his price for them: he therefore concentrated on the construction of a large machine, which he brought back to Victoria in 1859 and—finding that Geelong's demand for ice was insignificant—installed it at a factory in Franklin-street, Melbourne, producing with it up to 10 tons a day. Commercially, however, the enterprise was a failure, and in 1861 Harrison was made bankrupt and the *Advertiser* was sold to Douglass and De Little, who promptly re-installed Harrison as editor. Tiring of the subordinate position, he in 1865 started the *Geelong Register*, but, lacking capital to maintain it, in 1866 turned it into a company which was soon bought out by Graham Berry (q.v.), Harrison going back to Melbourne, where he became sub-editor of the *Age*. In 1873 he became notable as the inventor of a new process of freezing carcases for export. The American process then in vogue merely froze the surface of the flesh—which sufficed for the short voyage between the United States and England, but allowed decomposition to occur internally during a long voyage, so that Australian meat after thawing rapidly developed putrescence. Harrison's process froze the meat right through, so that all natural decay was suspended no matter how long the voyage lasted, and, after a slow thawing (20 hours at a temperature of 63°) the body fluids re-appeared as fresh as when they had been frozen. For this he was awarded a gold medal at the Melbourne exhibition of 1873, and, on proving that the cost of freezing and freightage would not exceed 7s. per ton, was given £2500 to take 25 tons of frozen beef to London. Unluckily the process that suited mutton perfectly would not do with beef. Twenty years later it was discovered that the small blood-vessels in beef carcases burst when frozen, and so, when thawed out again, damage the flesh they are embedded in. Beef must be chilled, not frozen; and Harrison's cargo was found unusable when thawed out in London. Of his later life little is known. He was away from Australia until 1892, but in that year returned to Geelong, settled down at Point Henry, and resumed intermittently his connection with the *Age*. He died on 3 September 1893.

For details of Harrison's carcase-freezing process see *Report on Meat Freezing Processes*, Victorian Agricultural Department, 1873. A.W.G.

Hart, JOHN (1809-1873), born in England in 1809, went to sea while still a boy and in 1831 became master of a sealing schooner hunting in Bass Strait and along the southern coast of Australia. (His first voyage as master, for instance, was from Launceston in Tasmania to Portland in Victoria, thence to Guichen Bay in South Australia, thence to Nepean Bay in Kangaroo Island; its result was 580 sealskins, and 12,000 wallaby-skins bought from the islanders.) In 1836 he left sealing for more general trade, taking from Launceston the first live stock ever landed in South Australia. Returning to London, he bought the *Isabella* for this trade, and brought her out, but in 1837 she was wrecked at Portland Bay. He next experimented with 'overlanding,' but about the end of 1838 established the headquarters of a whale-fishery at Encounter Bay. He seems to have been an experienced and reputable seaman, for his services were always in demand, even after his vessel had been wrecked.

In 1846 he gave up the sea and devoted himself to flour-milling at Adelaide, making one of the best brands of flour known in Australia. Indignant at the harsh terms imposed by Governor Robe (q.v) on intending settlers, he entered politics, succeeded in getting the grievance remedied, became a member of the council of 1851, and when responsible government was introduced was elected to the legislative assembly as member for Port Adelaide in 1857. He was treasurer in two of the ephemeral ministries of 1857-8, and chief secretary in four others in 1863-5; then he was thrice premier (October 1865 to March 1866; September-October 1868; May 1870 to November 1871). Although the conditions of the colony made tenures of office almost spasmodic, he managed to do effective work. During his last premiership he carried through the construction of the overland telegraph line to the Northern Territory, a region in which he was much interested; and his financial measures were always sound and much approved of, his experimental issue of five per cent bonds in 1871 being an especially notable success. He was the first advocate of consolidating the colony's public debt. On 28 January 1873 he died suddenly at Adelaide while addressing a meeting of the Mercantile Marine Insurance Company, which he had helped to found in 1869. (C.M.G., 1870.)

Hartog, Dirck. See AUSTRALIA, DISCOVERY OF.

Harvest-men (harvest-spiders), the vernacular name of arachnids of the order Phalangida, often called Opiliones. They are easily distinguished from spiders by the fact that the cephalothorax and abdomen are not separated by a constriction but fused together; they are sometimes mistaken for mites, but may be distinguished from them by their segmented abdomens. The legs, too, are usually long and slender, and this serves as an additional aid to identification. The upper part of the cephalothorax often bears a grooved and spiny turret, on the sides of which are placed a pair of simple eyes; on the lower surface there is situated, as in spiders, a 'sternum,' while a labium is usually present. The form of the sternum is highly important for purposes of classification. The cephalothorax is always unsegmented, the abdomen always segmented to a greater or less degree, the number of segments varying as the fusion of the cephalothorax with the abdomen is more or less complete. Hansen and Sörensen give the normal number of segments as 10, but this is subject to variation in different species.

Harvest-men, like other members of the Arachnida, have six pairs of appendages. The first pair, the three-jointed chelicerae, are very long in some forms, and usually terminate in a pair of pincers (chelae). The second pair, the pedipalpi, are non-chelate and have six joints, which correspond to similar segments in the legs. The legs, which like those of spiders have seven joints (the seventh being the metatarsus), are usually long and brittle. Silk-spinning glands are absent, and harvest-men are therefore unable to construct nests.

The order is subdivided into three sub-orders: (1) Cyphophthalmi, (2) Mecostethi, (3) Plagio-

stethi. The first sub-order is not represented in Australia. The second is characterized by its long and narrow sternum. Each of the tarsi of the first two pairs of legs is provided with only a single claw, but the last two pairs have two claws each. The great majority of our harvestmen are included in this sub-order, which is further divided into six families, the largest being the Triaenonychidae; a representative of this family is *Triaenonyx rapax*, which occurs commonly under logs in the dense brushes of the northern rivers of New South Wales. Members of the third sub-order, the Plagiostethi (sometimes termed Palpatores), are distinguished by having the sternum of the cephalothorax short and transverse, while the tarsi of the legs have only a single claw. Only one family of this sub-order appears to be represented in Australia, the Phalangiidae, of which *Macropsalis serritarsus*, known from the Jenolan caves, may be regarded as typical.

See Sörensen in Koch's *Die Arachniden Australiens* (Suppl. 1884-89); Roewer in *Archiv. Naturgeschicte* (1915, 80A, Heft 12), and in *Ark. Zool. Stockholm* (1920, Band 13, No. 18); Pocock in *Proceedings* of the Zoological Society of London (1902, vol. ii), and Hansen & Sörensen's *Two Orders of Arachnida, Opiliones & Ricinulei* (1904).

A. M.

Hassall, Rowland (1768-1820), was one of the laymen in the party of missionaries who were sent by the London Missionary Society in 1796 to Tahiti, and who in 1798 were forced to abandon their mission and take refuge in New South Wales. Hassall on arrival in Sydney at once made friends with Marsden, and stayed with him for a few weeks: then Hunter granted him 100 acres at Dundas, and he settled down to farm them, preaching to scanty congregations alternately at Toongabbie and Kissing Point. Judging by his extant correspondence, he was ill-educated: this defect, and his lack of orders, prevented him from being taken on the staff of chaplains, and in September 1800 King, acting on a recommendation from Hunter, appointed him caretaker of the Parramatta granary and storekeeper at Toongabbie. This work, however—entailing constant watchfulness against the frauds and forgeries of unscrupulous men, and enough business ability to cope with their cunning—was far beyond Hassall's powers, and in September 1802 he was dismissed. That nothing more than unsuitability was charged against him is clear from the fact that King, when he left the colony, gave Hassall charge of his own herd of cattle; and Dr. John Harris in 1807 praised Hassall's assiduous care and mentioned that he was 'in the background' with Governor Bligh just because he was so careful of King's interests. (He put himself on record, however, as a supporter of Bligh's when the mutinous New South Wales Corps deposed him.) In 1804-5 he was enrolled in the Parramatta company of volunteers as sergeant: at this time, King not having yet left the colony, he was looking after a flock of crossbred sheep partly owned by two other persons, and Marsden was helping him to improve the strain in his own section.

In 1814 Macquarie made him superintendent of government herds, and he seems to have held this post until his death at Parramatta on 28 August 1820.

Haswell, William Aitcheson (1854-1925), born at Edinburgh on 5 August 1854 and educated at the Edinburgh Institution and the university of Edinburgh (B.Sc., 1878; D.Sc., 1897)—where he studied under T. H. Huxley and won the Baxter scholarship—in 1879 migrated to Brisbane and in 1880 became curator of the museum there; in 1882 he was appointed lecturer in zoology and demonstrator of histology at the university of Sydney. In 1890 he was made Challis professor of biology, and when in 1915 that chair was divided became Challis professor of zoology; on his resignation in 1918 he was made professor emeritus. In learned circles in Germany he, Anderson Stuart, and Edgeworth David were reckoned the three Sydney professors who had 'achieved something for science and made the Australian universities notable in the learned world' (Schacht). In 1892-3 he was president of the Linnean Society of New South Wales; in 1897 he was made a fellow of the Royal Society; from 1912 to 1917 he sat on the university senate. Besides a large number of zoological papers and pamphlets, he published in 1898 a *Text-Book of Zoology* (written in collaboration with Professor T. J. Parker) and in 1899 a *Manual of Zoology*. The *Text-Book*, which was republished in 1910 and 1921—and had by that time become almost wholly Haswell's work—is recognized all over the world as the standard English textbook on the subject. His special studies were concerned with the invertebrates, and at the time of his death he was engaged in investigating a group of flat-worms (q.v.), the Temnocephaloidea, which afford important evidence of a former land-connection between Australia and South America by way of the Antarctic continent. He died at Sydney on 24 January 1925.

Hawks, birds, usually of moderate or large size, with strong hooked beaks and stout sharp claws, belonging to the order Accipitriformes. Twenty-five species occur in Australia, including

Wedge-tailed Eagle.

representatives of the groups known as eagles, harriers, goshawks, kites, falcons, kestrels, and ospreys. There are also several peculiarly Australian species, whose relationships and proper position in the order are not yet determined.

The best-known of Australian hawks is the Wedge-tailed Eagle or Eagle-hawk (*Uroaëtus audax*), found throughout the continent and Tasmania; it is one of the largest eagles in the world, sometimes having a 10-foot spread of wing. Its coloration varies from rufous-brown to black. Its natural food is wallabies, young kangaroos, and large birds such as bustards—also carrion; but it has taken readily to rabbits since they were introduced, and occasionally kills lambs—for which reason enormous numbers have been destroyed by pastoralists, advantage being taken of the bird's carrion-eating propensities to poison carcases. Many pastoralists, however, maintain that this is a mistaken policy, regarding the few lambs taken as amply compensated for by the eagle-hawk's destruction of rabbits and of carcases in which blowflies would breed. It is to be hoped that this view will become general before such a fine bird is exterminated.

Four other Australian hawks are classed as eagles, the finest being the White-breasted Sea Eagle (*Haliaëtus leucogaster*) (a near relative of the bald eagle of the United States) which is found all round our coasts. This species builds immense nests of sticks, either in trees or on rocky islands, almost always near the sea, the structure being added to year by year; such nests were seen by several early explorers, probably first by Vlamingh in 1697. Flinders remarks that 'if the magnitude of the constructor be proportionate to the size of the nest, *Terra Australis* must be inhabited by a species of bird little inferior to the condor of the Andes.'

The commonest of the Australian eagles is the Whistling Eagle (*Haliastur sphenurus*), which occurs wherever there is water in the neighbourhood. It is a valuable scavenger, and also destroys numbers of large caterpillars, of which it appears to be specially fond. The White-headed Sea Eagle (*Haliastur indus*) is the bird known

White Goshawk.

in India as the Brahminy kite. It occurs all round our northern coasts wherever there are mangroves. The Little Eagle (*Hieraëtus pennatus*), a rare species, is chiefly found far inland.

Two harriers occur in Australia, the Spotted Harrier (*Circus assimilis*) chiefly found inland, and the Swamp-hawk (*Circus approximans*), plentiful wherever there are swamps in the coastal districts of southern Australia and Tasmania.

Australia has also two goshawks, one of which is remarkable because it exists in two distinct colour-forms, gray and white. The latter form is more widespread, being found in Tasmania and north-western Australia, where the gray bird is unknown. In northern and eastern Australia, where the two forms occur together, they frequently interbreed; but some authorities still consider them distinct species, calling the gray bird *Astur clarus* and the white bird *Astur novaehollandiae*. The Collared Sparrow-hawk (*Accipiter torquatus*) the only true sparrow-hawk in Australia, is closely related to the sparrow-hawk of England; but the name 'sparrow-hawk' is often applied to the kestrel, a very distinct bird.

Of kites Australia possesses four species; the Black Kite (*Milvus migrans*), whose range extends to southern Europe, the Square-tailed Kite (*Lophoictinia isura*), peculiar to Australia, and two small blue-gray birds—the Black-shouldered Kite (*Elanus axillaris*) and the Letter-winged Kite (*Elanus scriptus*), both chiefly confined to the inland districts.

The so-called Red Goshawk (*Erythrotriorchis radiatus*) of northern Australia is really related to the buzzards of other countries; but the

Crested Hawk.

affinities of the fine Black-breasted Buzzard (*Hamirostra melanosterna*), the most distinct of the endemic species, are still undetermined. The curious Crested Hawk (*Baza subcristata*), perhaps the handsomest Australian member of the family, inhabits tropical scrubs along the northern and eastern coasts of the continent.

Australia has four true falcons (*Falco*), of which the Black-cheeked Falcon (*Falco peregrinus*) is perhaps the finest. This bird has an almost world-wide range, being known in England as the peregrine falcon and in the United States as the duck-hawk. The Little Falcon (*Falco longipennis*) is the commonest and perhaps the boldest of our falcons, capturing birds often much larger than itself.

The Brown Hawk (*Ieracidea berigora*), like the gray (or white) goshawk, exhibits dimorphism, though some authorities regard the two forms as distinct species. One form is very dark brown, almost black below; the other is sandy-brown, with dark streaks on each feather. In some localities one form only occurs, in others both are found together, and intermediates are not uncommon. The brown hawk is distinctly intermediate between the rapidly flying true falcons and the constantly hovering kestrels. It frequently hovers like the latter, but is not nearly so clever as its smaller relative.

The Australian representative of the kestrels is the Nankeen Kestrel (*Cerchneis cenchroides*), the commonest of all hawks throughout Australia and Tasmania. It is often called 'sparrow-hawk;' but this name gives an erroneous idea of its habits, and belongs to a very different species. Its food consists almost entirely of mice, lizards and large insects; while watching for them, it hangs poised and stationary in the air, with rapidly beating wings. In power of hovering it is surpassed only by the tiny humming-birds of America.

Finally we must mention the Osprey or Fish-hawk (*Pandion haliaëtus*), common on most parts of the Australian coast, which is found almost throughout the world. W.B.A.

Hay, Sir John (1816-1892), born at Little Ythsie in Aberdeenshire and educated at the university of Aberdeen (M.A., 1834), studied for the Scottish bar in Edinburgh, but in 1838 migrated to New South Wales and took up land for pastoral purposes at Welaregang on the upper Murray. He was already interested in politics, and in 1839 spoke on freetrade at a meeting in Albury; but his first active appearance in this sphere was in April 1856, when the Murrumbidgee constituency elected him unopposed as its representative to the new assembly. Carrying in September a vote of want of confidence in the Cowper-Martin ministry, he became secretary for lands in Parker's ministry, which lasted until 7 September 1857. He represented successively the Murray (1858-64) and Central Cumberland (1864-7), spending the first few years in opposition, and being chosen as speaker on 14 October 1862; this post he resigned for reasons of health on 21 October 1865. In 1867 he was nominated to the council, and on 8 July 1873 became president of that body, a position which he held until his death on 20 January 1892.

Hay was a consistent opponent of the Robertson land-policy of 'free selection before survey,' and in 1860 carried an amendment deleting it from the crown lands alienation bill; but the ensuing dissolution resulted in Robertson's return with an enlarged majority. Hay also repeatedly advocated a customs union with Victoria, so as to ensure the abolition of customs houses along the Murray. (K.C.M.G., 1878.)

The above-mentioned Sir John Hay must not be confused with Sir John Hay (1841-1909), a nephew of David Berry, who, inheriting the Berry estate in 1889, sent to the university of St. Andrews in Scotland Berry's bequest of £25,000 and was made LL.D. therefor. In 1907 he was made commissioner from New South Wales to the Anglo-French exhibition of that year, and was knighted for his services.

Hayes, Sir Henry Browne (1762-1832), born at Cork in Ireland in 1762, and admitted freeman of that city on 12 November 1782, was for the next 15 years a prominent figure in Cork society: in 1790 he was sheriff, and a few years later was commissioned captain in the South Cork militia. In 1797 he abducted an heiress, but let her return to her home unharmed after a sham marriage. He was promptly outlawed and had a reward of £1000 offered for his apprehension, yet after a short interval he was again living peacefully in Cork, whereas the heiress was forced by public opinion to retire to England. However, in 1800 he offered —possibly thinking that his local popularity would secure an acquittal—to stand his trial at Cork, and in April 1801 he was found guilty, mainly owing to the extraordinary ability and tact of J. P. Curran, counsel for the prosecution. In August Hayes was condemned to death, but in September the sentence was commuted to transportation for life. Put aboard the convict transport *Atlas,* which sailed from Cork on 28 November 1801, he paid the master several hundred guineas to obtain exceptional favours, and much annoyed the free officials who were travelling in the same vessel by monopolizing most of the free space and nearly all the available comforts. Among these officials was Thomas Jamison, on his way to take up the surgeon-generalship of the colony; he left the vessel in anger at Rio de Janeiro, took passage in the *Hercules,* and reached Sydney ten days before Hayes, against whom he at once instituted an action for 'threatening and improper conduct.' Hayes was sentenced by the magistrates to six months' imprisonment, but after serving five-sixths of the sentence was given a ticket of leave and sent to Parramatta, under threat of exile to Norfolk Island if he dared return to Sydney. Unused to any compulsion that could not be mitigated or removed by his wealth, Hayes complained indignantly to the authorities in London, and set himself to attack and annoy Governor King. Having in some way (he himself calls it 'being liberated by a respectful bench of magistrates') been enabled to return to Sydney, he applied for leave to hold a masonic lodge (see Freemasonry); leave being refused, he held it all the same, and in May 1803 was ordered to hard labour at the settlement then proposed to be made in Tasmania. This, too, he managed to evade, for on 22 August he bought two farms near South Head —the well-known Vaucluse estate which was in later years the home of William Charles Wentworth. Here he lived for some years, though—being still a convict—he could not obtain a legal title to the property. King, who firmly believed that Hayes was concerned in the insurrection of March 1804, suffered greatly from his bitter personal attacks both in the colony and by letter to the colonial office, and in July 1805 obtained from five magistrates (Johnston, Marsden, Harris, Jamison, and Atkins) an opinion that his exile would be the best means of maintaining peace at Sydney: Hayes was therefore sent to Norfolk Island, but after a month there brought back to Sydney for exile to Tasmania. Again his luck held: storms delayed the vessel bound for Tasmania, and before the fresh sentence could be carried out Bligh had succeeded King as governor.

Under Bligh Hayes calmed down and spent his time mainly at Vaucluse. But the mutiny against Bligh involved Hayes also; having openly sympathized with the deposed governor, he was sent by Johnston in March 1808 to the dreaded Newcastle coal-mines. Eight months later Foveaux allowed him to return to Vaucluse;

but in May 1809 he was again sent to the coal-mines, and on this occasion fell foul of Lieutenant Lawson, who charged him with 'bringing the existing government into ridicule and contempt.' It is not clear how Hayes was released on this second occasion, but in March 1810 he was back at Vaucluse memorializing Macquarie about Lawson's ill-treatment of him. His support of Bligh now stood him in good stead. Bligh had in April 1809 written out a full pardon for him, but could not make it effective because the mutineers had the colony's great seal. The colonial office, therefore, in August 1811 notified Macquarie that Bligh's intentions should be carried into effect if Hayes had been behaving himself properly. The despatch was slow in coming, but in November 1812 Macquarie issued the pardon, and on 4 December Hayes left the colony in the *Isabella*, with Joseph Holt (q.v.) as a fellow-passenger. The ship was wrecked on the Falkland Islands, and (according to the journal of one of her officers) Hayes with a few accomplices endangered the lives of the other passengers by stealing the small boat and making for shore. After many adventures all were rescued and Hayes returned to Ireland in 1814. The rest of his life was spent in retirement at Grantham Hill near Cork, where he died in May 1832. (Kt. Bach., 1790.)

The story of Hayes's connection with Vaucluse House is fully told in the *Journal* of the Royal Australian Historical Society, vol. iii, pp. 507-30. It may be noted here that the best-known part of it—his attempt to banish snakes from the precincts of Vaucluse by surrounding the house with turf brought from Ireland, and therefore endowed by St. Patrick with anti-ophidian properties—is probably true. The bill of lading for the imported soil was in existence late in the last century.

Hayes, Sir John (1767-1831), born probably in Cumberland, certainly in 1767, at the age of 13 joined the Bombay marine service (midshipman, 1781; 2nd lieutenant, 1788; 1st lieutenant, 1792; commander, 1799; captain, 1802), and saw much fighting in the wars with France and Tippoo Sahib during 1781-92. In 1792, the war being over, Hayes met in Calcutta a fellow-officer, John McCluer, who in 1790 had been instructed by the Indian government to survey the Pelew group and northern New Guinea in the neighbourhood of the gulf now known by his name. McCluer was struck with the rich vegetation of the country, and especially with the frequent occurrence of the Banda nutmeg (the most valuable of Malayan spices), which at that time was believed to exist only in Banda and Amboina. On McCluer's information Hayes formed a small syndicate to fit out two vessels—the *Duke of Clarence* and the *Duchess*—to exploit the new discoveries. Starting from Calcutta on 6 February 1793, Hayes made for New Guinea direct, but was met off Timor with such strong SE. trade-winds that he determined to reach New Guinea by the long voyage round New Holland; he therefore rounded Western Australia, and on 25 April anchored in the mouth of the Derwent. Not knowing that other explorers had preceded him (Bligh and D'Entrecasteaux among them), he made careful surveys of the whole surrounding country, including Bruni Island, and scattered names profusely over his chart. It is the fact that most of these names are Cumbrian that makes Hayes's birthplace almost certain; he called the mainland 'New Cumberland,' the river 'Derwent,' the hill now known as Mount Wellington 'Skiddaw,' and so on. Few of his names are now in use, as those given by previous explorers had the priority, but it may be noted that Risdon Cove was named after the 2nd officer of the *Duke of Clarence*. Hayes took his vessels up the river beyond Mount Direction, and explored it with boats a long way above Bridgewater. On 9 June he left Storm Bay and made for New Caledonia, which he coasted within the barrier reef at least from Bourail to Gomen; he then cut across to the Louisiades, discovered (as D'Entrecasteaux had a month earlier) that they were islands, and after a vain attempt to thread the reefs immediately south of the mainland doubled back round Rossel and Woodlark islands to New Britain. Here he ran through St. George's Channel, back to the New Guinea coast, and across Geelvink Bay to Dore at its north-western corner. In this region he found the coveted nutmeg, as well as cloves and birds of paradise, and promptly annexed the north-eastern coast of New Guinea from end to end in the King's name on 25 October as the colony of New Albion. Leaving the *Duchess* at Dore Bay, he started back to India, but, reaching Batavia on 18 June, found the Bengal squadron there and was ordered to Canton. He completed this voyage after an exciting chase by a French privateer, met McCluer in Macao on a trip from the Pelews (where he had settled), and eventually reached Calcutta on 5 December. He had hoped to persuade the East India Company to accept and protect his precious New Albion, but it was at the time under pressure—after the annexations of Warren Hastings—to confine itself strictly to mercantile business, and refused to interfere, although it denied any right in the Dutch to prevent the annexation if approved of. Sir John Shore, the governor-general of India, after discussing the matter thoroughly, managed to discover 'positive orders from the Company prohibiting new settlement to the eastward,' and the annexation came to nothing; but it was not until 1828 that the Dutch formally laid claim to New Guinea (as a possession of the sultan of Tidore) and began to establish trading stations there. It may be added that the party Hayes had left behind at Dore was succoured towards the end of the year by McCluer, who had heard about them from Hayes at Macao, and was taken off by Risdon (who had succeeded Hayes in the command of the *Duke of Clarence*) in June 1795; but trading operations with the Papuans continued at least until 1801.

Hayes in May 1795 rejoined the Bombay marine service, and in 1796 entered on a period of active war-work which earned him in May 1798 a sword of honour for intrepid behaviour. In 1799 he served ashore in the campaign that ended with the capture of Seringapatam; then he was sent to the Persian Gulf, and then (1801) to the siege of Ternate, at which he commanded the assisting squadron. In 1803 he was given command of a squadron assigned to defend the Bay of Bengal, and in 1805 was made a commodore; in 1805-7 he visited England, was received with honour by the directors of the Company, and was made deputy master attendant at Calcutta with the right to succeed the holder of the senior position. To this he succeeded in 1809, and held it for the next 21 years, with two intervals during which he was again sent on active service—in the Java expedition of 1811 and the Burmese war of 1824-5. In 1830 his health gave way, and he was given an E.I.C. cruiser for a voyage to

Sydney, but on the way fell so seriously ill that he had to be landed at Direction Island in the Cocos group, and died there on 3 July 1831. (Kt. Bach., 1826.)

The only full and accurate account of Hayes's life is contained in Ida Lee's *Commodore Sir John Hayes* (1912). He kept full journals of his voyage of 1793-4, and intended to publish them, but could not obtain the requisite financial support. They have since been lost; according to one account they were captured by a French warship and taken to Paris, but no trace of them has been found there.

Heales, RICHARD (1823-1864), son of a London ironmonger, migrated to Victoria with his father in 1842 and worked for some years as a coach-builder; interesting himself in municipal affairs, he was in 1849 elected a member of the Melbourne city council, and during the next few years took up the cause of temperance with ardour. When Victoria obtained responsible government, Heales was elected by East Bourke to the assembly and became leader of the advanced liberals; in this capacity he opposed bitterly the Nicholson land act of 1860, helped to oust that ministry, and was chosen by ballot among members of the opposition to form its successor. During his year of premiership (26 November 1860 to 14 November 1861) he accomplished little, but in 1862 succeeded as a private member in carrying through both houses a common schools act on which all subsequent educational legislation in Victoria has been based. In June 1863 he joined the McCulloch ministry as president of the board of lands and works, but after a couple of vain attempts to pass bills amending the Nicholson land act succumbed to ill-health and overwork, and died on 19 June 1864. Heales was an excellent example of what in recent times would be called a 'labour' member. Sprung from the working class, his aim throughout his political career was to improve both the working conditions and the *moral* of the artizans he knew so well; for this reason he steadily advocated free education, freer land settlement, temperance, protection of native industries, and reform of the legislative council. 'Few men' wrote H. G. Turner, 'who have had so short a public career have left more friendly memories behind them.'

Heaton, SIR JOHN HENNIKER (1848-1914), born at Rochester in Kent on 18 May 1848 and educated at King's College, London, in 1864 migrated to Australia to acquire 'colonial experience' and, after several years of pastoral life, became a journalist and married the daughter of Samuel Bennett (q.v.). He then settled down to the compilation of his *Australian Dictionary of Dates and Men of the Time,* the first serious attempt to make a 'digested summary of every branch of Australian history;' this was published in Sydney in 1889. Returning to England in 1883 as commissioner for New South Wales to the Amsterdam exhibition of 1884, he took up the advocacy of cheap postal and telegraphic rates between the mother-country and her colonies with which his name is indissolubly connected. In 1885, as representative of Tasmania at an international telegraphic conference in Berlin, he obtained a reduction in the cable charges between England and Australia; being in November of that year elected to the house of commons from Canterbury (which he represented uninterruptedly till 1910), he pursued his campaign there with vigour, and in 1891 procured the reduction of Anglo-colonial postage rates from 6d. to 2½d. the half-ounce; almost immediately he began a campaign for a further reduction to 1d. per half-ounce, and this was secured in 1898; and by 1908 he had persuaded the government to make the same concession with regard to postage between Britain and the United States. He also procured other postal reforms (such as the introduction of telegraphed money orders), and till his death fought hard to lower still further the cable rates between England and Australia. He died at Geneva on 8 September 1914. (Baronet, 1912.)

Helichrysum, a large genus of the family Compositae, popularly known as everlastings, and consisting of herbs, undershrubs, or shrubs with leafy stems, often clothed with cottony wool. Represented in most warm and temperate regions, it is especially varied and widely distributed in Western Australia, in which about 70 species are endemic. The involucral bracts are usually rigid and scarious, simulating petals; pappus bristles simple, barbellate, or plumose at the tips only. *H. lucidum,* with numerous horticultural varieties, is largely cultivated as a garden plant; the white-flowered varieties, under the name of immortelles, are used in making funeral wreaths. *H. ferrugineum* (Native Lavender), a strongly scented shrub, has small flowers with shining bracts collected in groups (corymbs); *H. rosmarinifolium* is a handsome, very floriferous shrub; and two Tasmanian species, *H. lycopodioides* and *H. selaginoides,* have moss-like leaves.

Helipterum, a genus of the family Compositae, consisting of annual and perennial herbs, rarely shrubs. It is confined to South Africa and Australia, the species in each region being endemic. The involucral bracts frequently have petal-like laminae; pappus bristles plumose from the base. The western *H. roseum* and *H. Manglesii* (better known to nurserymen as *Acroclinium* and *Rhodanthe* respectively, and often erroneously called 'everlastings') are largely cultivated and used for decorative purposes. *H. incanum,* of which there are both white and yellow varieties, is very ornamental. In alpine regions it is thickly coated with silky hairs and dwarfed, flowering when only one or two inches high.

Hematite. See IRON.

Hemiptera, a large order of insects, including cicadas, hoppers, plant-lice, scale-insects, and bugs; it is well represented in Australia, where the number of described species is little short of 2000—and this is only a small part of the total hemipterous fauna of the continent. Of these more than 1000 belong to the Homoptera, while the Heteroptera number less than 900.

The order as a whole is difficult to define, but its members may be recognized at once by the possession of a jointed sucking-beak differing in structure from that found in any other group of insects. Fore- and hind-wings differ greatly in size, shape, and venation; in most cases, the fore-wing is much tougher than the hind, being a kind of tegmen. The legs have tarsi with never more than three joints, and there are no cerci. As a general rule, the larval stages differ little from the imago, though in some advanced Homoptera the male may undergo a very striking metamorphosis.

The Hemiptera are naturally divisible into two very distinct sub-orders, considered by some to be two separate orders; but both can be traced back to a common stock in the Permian

era, and they stand so far apart from all other insects that they are best treated as a single order.

The sub-order Homoptera is distinguished by the unspecialized form of the fore-wings, in which there is no division into corium and membrane (see below under Heteroptera), by the fact that the species (with few exceptions) hold their wings roofwise over the body while at rest, and by the head being so bent under the thorax that the beak projects far backwards, extending between the front coxae. Cicadas (q.v.) belong to this sub-order. Their nearest relatives are the Cercopidae (spittle insects), of which only 30 have been up to now described from Australia. The sub-family Cercopinae, containing the true spittle insects, is represented by several genera, of which the most abundant is *Philagra*. In this genus, which occurs on *Casuarina* trees, the head of the imago projects far forward like a snout. In the Machaerotinae (tube-forming cercopids) we have the two interesting genera *Pectinariophyes* and *Polychaetophyes*, which form delicate tubes attached to the stems of eucalyptus saplings; the larvae live inside these tubes in their own froth, and suck the sap of the stem.

Closely related to the Cercopidae, but at once distinguished by their transverse hind-coxae and angulated hind-tibiae, are the Jassidae (plant-hoppers), very abundant in Australia as elsewhere. About 200 Australian species have been described, but very many are still undescribed. Our most striking sub-family is the Bythoscopinae, containing the genus *Eurymela* and its allies—rather large, broad-headed hoppers of dark and striking coloration, which sit about on stems of eucalyptus saplings, and are generally attended by ants. Plate xix fig. 8, shows the handsome but common *Eurymela bicolor*.

The Ledrinae include some large brown jassids with very prominent prothorax, rounded in front. The allied Stenocotinae also contain large brown forms, peculiar to Australia; their larvae are very flattened, and may be found under bark. Amongst the numerous smaller forms (placed in several sub-families) the little hoppers of the genus *Ipo*, with their broad heads and wedge-shaped bodies, are very common; other well-known genera are *Tartessus*, *Idiocerus*, *Xestocephalus* and *Vulturnus*.

The Membracidae (tree-hoppers) are much like Jassidae, but are specialized by the extraordinary development of the pronotum—which in Australian species usually extends forward and upward in the form of two large horns of various shapes. Our best-known genera are *Sextius*, *Eufairmairea*, *Daunus*, and *Centrotypus*. We have about 40 named species.

The super-family Fulgoroidea includes all hoppers originally placed in the old family Fulgoridae, and now split up into a number of distinct families. All are recognizable by the long and well-separated middle coxae, and by the presence of a distinct tegula in the form of a small scale at the base of the tegmen; usually, moreover, the veins of the anal area (clavus) of the tegmen form a distinct Y. About 250 Australian species are known, and many more must be awaiting description. Plate xix, fig. 9, shows the beautiful *Desudaba danaë* from Queensland and fig. 10, the pretty, green, moth-like *Siphanta acuta*, a very common species. *Achilus flammeus* is a handsome rose-red insect, not uncommon. We have a number of peculiar long-winged Derbidae, of which some fine species of *Zoraida* are still undescribed.

Passion-vines, especially in Queensland, are injured by a frog-hopper (*Scolypopa australis*), which in some seasons appears in great numbers. These insects also infest species of *Solanum*; and, when they are disturbed by the passage of a horseman through a batch of plants, their hopping makes a noise resembling a hailstorm.

Psyllidae (lerp-insects) are numerous in Australia, and almost entirely replace the more advanced family Aphidae. About 80 species of psyllids have been described; perhaps the best-known is the Sugarlerp-insect (*Spondyliaspis eucalypti*). Species of *Psylla* are very abundant on wattles, and sometimes quite destroy the flower-buds of these trees. 'Lerp' is the glutinous matter secreted by psyllids in their larval stage and exuded by them.

The minute Aleurodidae (snow-flies) are represented by a few species; it is easy to confuse them with the tiny white Coniopterygidae of the order Planipennia (q.v.), which they much resemble superficially. Like the Coccidae, with which they are also confused, they live on the juices of plants, being furnished with a sucking-tube. Both sexes have two pairs of wings. Their name is derived from the white dust with which they are clothed. The larva, as it emerges from the egg, constructs a scale-like covering, beneath which it develops. About eight Australian species have been described. One cosmopolitan aleurodid is common in plant-houses and gardens, and another is a pest on orange-trees in America. The Coccidae (q.v.) also belong to this sub-order.

The sub-order Heteroptera includes the true bugs and water-bugs, which are probably almost as numerous in Australia as the Homoptera, but have not received such careful attention. They are at once recognizable by the form of the fore-wing, which is known as a hemiëlytron (half-sheath); the basal half (corium) is hard, the distal half (membrane) more delicate and membranous, with a sharp dividing line between the two portions. The wings are held flat on the back, and the beak is inserted near the anterior end of the head. Of the terrestrial families the most abundant (and one of the most highly specialized) is the Pentatomidae, of which nearly 400 species have been described from Australia, mostly by Distant. Many species are brilliantly coloured; most have a very offensive musk-like odour and, being almost exclusively plant-feeders, are often injurious to both fruit and vegetables. Our most abundant genera are *Tectocoris*, *Chaerocoris*, *Poecilometis*. *Dictyotus*, *Cuspicona*, and *Rhoecocoris*. Plate xix, fig. 12, shows the large and handsome *Oncomeris flavicornis*, from northern Queensland. Much less numerous in species are the Coreidae, a group in which the scutellum is much shorter than in the previous family. A well-known example of this family is the Crusader-bug (*Mictis profana*), a dull-brown species, carrying a conspicuous cross on the hemiëlytra; it is common in the bush, and sometimes damages citrus orchards.

The Pyrrhocoridae only differ from the last-named family in having no ocelli. There are few Australian species; *Dindymus versicolor* (Harlequin Bug), is a handsome red-and-black insect, which does much damage in gardens.

The Lygaeidae (chinch-bugs) are represented in Australia by more than 100 species, mostly of small or moderate size, and often marked with

red. Our most notorious species is the Rutherglen Bug (*Nysius vinitor*), one of the very worst pests on grape-vines and crops of all kinds, including wheat and potatoes.

The Berytidae (stilt-bugs), the Tingidae (lace-bugs), the Aradidae (fungus-bugs), the Miridae (leaf-bugs), and the peculiar, truncated Gelastocoridae, are represented in Australia by a total of barely 100 species altogether, of which the Miridae claim about 50. Little is known about them, and many more species are sure to be found. The Reduviidae (assassin bugs) are a carnivorous group, and therefore potentially of economic value. They can be at once distinguished by the stout, curved beak, the elbowed antennae, and the large basal cells on the membrane of the hemiëlytron. About 120 species have been described from Australia, many of them very handsome insects. Plate xix, fig. 13, shows the Western Australian *Havinthus rufovarius*, a beautiful red-and-black species.

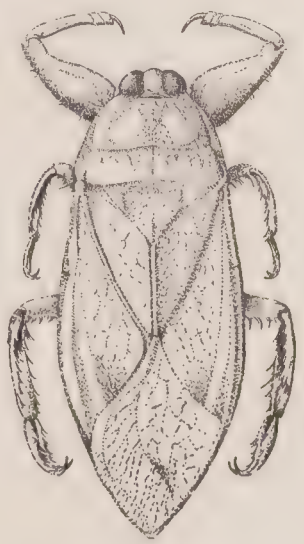
Comparatively few bugs are serious pests, and but few have been introduced; but that universal denizen of unclean dwellings, the Bed-bug (*Cimex lectularius*), is too often in evidence. Though not definitely proved to carry disease, this pest has been suggested as a transmitter of kala-azar (Leishmaniasis) as well as of leprosy. Cotton-plants in the Cairns district are attacked by a large bug (*Tectocoris diophthalmus*), which varies in colour from purple to red. This is one of the few insects—outside the 'social Hymenoptera'—that shows maternal care of its offspring, since the female watches over the eggs and newly hatched young for some time. This and the graceful *Dysdercus sidae* (which attacks maize as well as cotton) range to Papua and the Malay region, and *Dysdercus* is found in New South Wales. The twigs and fruit of oranges in New South Wales and Queensland are punctured by a large bronze bug, *Rhoecocoris sulciventris*. This insect, when disturbed, ejects an acid and evil-smelling fluid that often painfully affects the eyes of pickers. *Biprorulus bibax* is a large green species, with two conspicuous spines, and injures twigs and fruit in a similar way.

The harlequin or soldier bug (already mentioned), besides swarming through apple orchards, attacks other insects and sometimes even its own kind, and may be seen walking off with a much larger insect, after the manner of the assassin bugs.

The Cherry-bug (*Peltophora picta*), the Coon-bug (*Oxycarenus luctuosus*) that swarms on cucumbers, potatoes, and similar plants, the Rice-bug (*Plautia affinis*), that attacks cereals, and the Olive-bug (*Froggattia olivina*), have also been recorded as pests.

Oechalia consocialis is one of the few useful Australian bugs. It destroys cutworms and other destructive insects, and one may often be seen on a grape-vine, bearing off a caterpillar many times its own weight. A species of *Gminatus* similarly destroys the pear- and cherry-slug in Tasmania. *Cermatulus nasalis* and *Glaucias amyoti* are also useful species.

Little attention has been paid to Australian water-bugs, and the number of described species is small. The Gerridae (water-striders) are represented by about a dozen species of *Gerris* and *Hydrometra*, as well as by a few species of the marine genera *Halobates* and *Hermatobates*. *Halobates whiteleggi* is found in Port Jackson. The Belostomidae are represented by the Giant Fish-killer (*Lethocerus indicus*), a huge insect reaching nearly three inches in length, and frequently taken at night, and by the curious genus *Sphaeroderma*, consisting of



Giant Fish-killer.

medium-sized oval bugs which inhabit water-weeds and carry their eggs about on their backs. The Nepidae (water-scorpions) are represented by a few species of *Nepa* and *Ranatra*; the huge *R. filiformis* is popularly known as toe-biter, from its vicious habit of wounding the feet of bathers. The Corixidae (water-boatmen) and the Notonectidae (back-swimmers) are abundant in ponds and rivers; but few species have been named.

See Tillyard's *Insects of Australia and New Zealand*.

R.J.T.

Hemp-bush. See PLAGIANTHUS.

Hen-and-chicken Fern. See FERNS.

Henderson, SIR EDMUND YEAMANS WALCOTT (1821-1896), son of Vice-admiral George Henderson, was born on 19 April 1821 at Middiford in Hampshire, educated at Woolwich, and entered the royal engineers (lieutenant, 1838; captain, 1847; major, 1858; lieutenant-colonel, 1862). From 1839 to 1845 he was stationed in Canada, and in June 1846 was again sent to that colony to survey a boundary between Canada and New Brunswick in the area ceded by the United States under the Ashburton treaty. He returned to England in November 1848, and in 1850 was appointed comptroller-general of convicts in Western Australia, a position which he held until 1863. To his wise administration is mainly due the fact that the convict system left so little stain on the colony. In 1852 he became an official member of the legislative council. Resigning in 1863, he returned to England and was appointed chairman of directors of prisons and surveyor-general. He retired from the army in 1864. In 1869 he was appointed chief commissioner of the metropolitan police, but resigned in 1886 in consequence of the Trafalgar Square riots. During his occupancy of the position he instituted the criminal investigation department. He died on 8 December 1896. (C.B., 1868; K.C.B., 1878.)

J.S.B.

Henry, LUCIEN. See ART.

Henty, EDWARD (1809-1878), the best-known member of a Sussex family that did pioneering work in three Australian colonies, was born at West Tarring in Sussex on 10 March 1809. In May 1829 his father, Thomas Henty, who was a breeder of merino sheep and eager to establish himself in the Australian region which he had heard was so suitable for them, sent out three of his sons (James, John, and Stephen) to the Swan River settlement, with 33 labourers and servants from the village of West Tarring, and 147 sheep. They reached Perth on 12 October, and James Henty promptly claimed land to the value of over £6000 (over 84,000 acres). The best and most accessible land, however, had already been allotted, and after two years of heart-breaking work they found their stock depleted by starvation and poisonous feed, and determined to shift to Tasmania. Here they settled at Launceston, and in 1832 were joined by their father and the rest of the family, Edward among them. Finding Tasmania also unsuitable—the price of land being too high and the area available too small—Thomas at the beginning of 1833 sent Edward off in a whaler to explore the southern coasts of the mainland; he investigated the shores of Spencer Gulf without success, was picked up at Port Lincoln by a schooner belonging to his father, and on the way back to Launceston anchored in June off the whaling station in Portland Bay. He explored the country for about 25 miles inland, and decided that it was exactly what he was looking for; in December he took his father there and secured his approval, and on 17 February 1834 Thomas Henty applied for a grant of 20,000 acres at 5s. an acre for himself and his seven sons. This being refused, Edward on 14 November left Launceston in the *Thistle* with 17 head of cattle and a miscellaneous collection of seeds and fruit-trees. He reached the Bay on the 19th, found it deserted, and proceeded to establish himself ashore; in December his brother Frank joined him, bringing the first merino sheep landed in Victoria, and when the whalers returned early in 1835 they found the new arrivals settled and comfortable. In after years William Dutton (q.v.) claimed that he had built a house at the Bay in 1829, and lived in it year by year, and was therefore the first colonist in Victoria; but Henty's was undoubtedly the first permanent settlement for cultivation of the land. In 1836 Stephen Henty, who had been left in Western Australia to wind up the family affairs there, joined his brothers and embarked on a whaling enterprise, and during the next few years Edward and Stephen explored the country north to the Wannon and west to the Coorong.

Although everyone in Launceston must have heard of the Hentys' settlement, it was otherwise unknown; and Mitchell, coming down on it on 29 August 1836 from his journey across the mallee country, was astonished to find tracks of cattle and the shoe-marks of a white man. It was his account of the land along the Wannon that sent Stephen and Edward in that direction, and just a year after his visit they placed their sheep on Merino Downs. Meanwhile Thomas Henty had been, through his son James, negotiating with the colonial office in London for the right to retain the Bay property in the family if settlement should at any time spread so far; this was necessary because in law the Hentys were merely trespassers on crown lands beyond the authorized bounds of settlement (which was then confined to the 'twenty counties' in New South Wales). Lord Aberdeen, the then colonial secretary, solemnly expressed his surprise that anyone should have dared to occupy land before the authorities in London had decided that it was ripe for occupation, but hinted that the Hentys might be given a title to any land actually fenced and cultivated. In 1840, however, the authorities in Sydney decided to lay out a township at Portland and sell allotments by auction, and refused to give the actual occupiers any advantage; Gipps, indeed (backed by Lord John Russell), denounced them as troublesome and objectionable, sold the land over their heads for £551 per acre in the township and £11 within two miles of the town, and early in 1842 took steps to eject them; but Russell's successor, Lord Stanley, held that Lord Aberdeen's hint was binding on him, and offered the Hentys all their fenced and cultivated area at the price of 'unimproved' land. In 1846, however, they obtained a free grant of land valued at £1290 and were compensated for the improvements they had made to the port.

Thomas Henty died in 1839, and in 1842 the brothers dissolved partnership. Edward, John, and Francis squatted along the Wannon, Stephen stayed at Portland; James had already a shipping and mercantile business in Launceston, Charles became manager of a bank, and William, who was trained for the law and in 1837 was admitted to the Tasmanian bar, entered the Tasmanian legislature and from April 1857 to November 1863 was colonial secretary in four successive ministries. Edward represented Normanby in the Victorian legislature from 1857 to 1861, then went back to his station, and died in Melbourne on 14 August 1878. Frank died there on 15 January 1889; James went to Victoria in 1851, was for a time a member of the legislative council, and died in 1882; and William, who returned to England at the end of 1862, died at Brighton on 11 July 1881.

Hepaticae. See LIVERWORTS.

Herbert, SIR ROBERT GEORGE WYNDHAM (1831-1905), a grandson of the first earl of Carnarvon, was born at Brighton in England on 12 June 1831, educated at Eton and Balliol College, Oxford (Hertford, Ireland and Eldon scholar; B.A., 1854; fellow of All Souls'; D.C.L., 1862), called to the bar in 1858, and brought out to Queensland by the first governor, Sir George Bowen, at the end of 1859. Bowen made him at first colonial secretary, then premier, and the constituency of Leichhardt returned him unopposed to the first parliament. For six years he ruled the new colony, partly by merit—for his ability was unquestioned—partly by virtue of the governor's unswerving support, and was responsible for the important measures on which Queensland's subsequent land and education policy have been based; these were the crown lands alienation act of 1860, with which R. R. Mackenzie (q.v.) aided him, and the education act and grammar schools act of 1860. Young, ardent and opinionated, he offended many good Queenslanders by his assumption of superiority and his early endeavours to model the colony's institutions on English patterns; but he was a quick learner, and during his long term of office repaired most of his own faults. In 1866 private business made necessary his return to England; he resigned the premiership on 1 February, took it back again (without portfolio) for about three weeks in July-August

to get the governor out of a difficulty, and sailed for England on 20 August. His colonial experience was soon put to use there. In 1868 he was made assistant-secretary to the board of trade, and in 1870 assistant under-secretary to the colonial office; the next year he became permanent under-secretary of state for the colonies, and held the position until 1892, and in 1899-1900. From 1893 to 1896 he was agent-general for Tasmania, and in 1904 chairman of a commission—privately appointed, but of some importance because it was connected with Joseph Chamberlain's tariff reform movement—which investigated the tendency of British trade-relations with the rest of the Empire. He died on 8 May 1905.

Herbert's career is full of minor incidents to which justice cannot be done in a summary. For a short time in the fifties he was private secretary to W. E. Gladstone, and the friendship was never broken; it is possible that several of the mannerisms which diminished Herbert's popularity in Queensland were acquired at that period. His father was a keen botanist, and the son developed a like taste for bird-lore, and took many Australian birds with him when he returned to England, for acclimatization on his estate in Cambridgeshire. At one time—towards the end of the century—he was adviser to the Sultan of Johore; and from 1892 until his death he was chancellor of the order of St. Michael and St. George. (C.B. and K.C.B., 1882; G.C.B., 1902.)

Hermit Crabs, marine crustaceans of the tribe Paguridea, one of the three tribes of the sub-order Anomura, order Decapoda. For convenience' sake the other two tribes, Galatheidea (porcelain crabs, etc.) and Hippidea (turtle and mole crabs), are dealt with under this heading below. The Anomura as a whole have been called 'irregular-tailed' crabs because in them the abdomen may be straight, more or less curled up under the body, or spirally coiled and asymmetrical; the last pair of legs is always reduced in size. The typical hermit crabs are well differentiated, but other Anomura may resemble both higher and lower forms. The Paguridea include four families, of which only one, the Paguridae, is importantly represented in Australia. Species of this family are plentiful on every section of our coasts; they may be found along the shore-line in harbours and estuaries, but more frequently inhabit deeper waters. The name 'hermit crab' is popularly applied to species that utilize the empty spiral shells of molluscs to protect their soft abdomens, because they have no hard outer covering (as have most crabs), but are wholly fleshy, and would offer, if unprotected, tempting morsels to hungry sea animals. The half-naked crabs are modified to suit the conditions of their life. The abdomen is spirally twisted; one of the claws is much bigger than the other, and closes the opening of a shell after the rest of the body is drawn in, thus barring the door against intruders. The creature is therefore rarely in danger, except when it is changing to a new shell from an old one that has become too small for it (this move is performed wonderfully quickly, the crab never leaving its old home till it has found a new one). Behind the claws occur two pairs of legs, which are strong and pointed. As the crab walks, these secure a firm hold of the ground, and enable him to draw a heavy shell after him. The two delicate pairs that follow are provided with roughened surfaces, which grip the smooth inner surface of the shell and enable the crab to shift its body within its house. Swimmerets, which are well developed in a few ancestral types, are reduced to small and stunted appendages in most hermit crabs. The 'tail-fan,' no longer broad and flat, is turned into a kind of grappling hook, which can secure such a firm hold of the smooth inner surface of a shell that the crab is scarcely ever dragged out alive.

Among the larger hermit crabs found along our coasts is the Stridulating Crab (*Clibanarius strigimanus*), characterized by the possession of series of ridges on the inner surfaces of the joints of the pincer-bearing limbs; when these are rubbed together, a peculiar rasping sound is produced. This species, along with the Scaly-legged Hermit Crab (*Dardanus arrosor*), another species of about the same size, occurs commonly in shallow water along most of the eastern and southern coast-lines. Many smaller forms, such as the Hairy-footed Hermit Crab (*Paguristes squamosus*), are found in rock-pools along the coast, more particularly in the tropics.

Certain members of the Paguridae have discarded shells as habitations, preferring other homes. Some live in corals, others in cavities in sponges; one is known to protect its abdomen by a cloak of living sea-anemones, held in position by its hinder legs, while another lodges itself in the mass of a soft marine animal colony called a zoantharian. A unique and remarkable

Miner Crab (full length).

form is the Miner Crab (*Cancellus typus*) of Port Jackson. This crab has an extended and bilaterally symmetrical abdomen; it lives in burrows, which it excavates in soft stones and cinders by the use of horny plates on its tail and posterior legs. When undisturbed, it roams about in search of food, dragging its often bulky abode after it; if alarmed, it withdraws into the burrow, and closes the aperture in the same way as

do other hermit crabs, its claws forming a close-fitting operculum.

The next tribe (Galatheidea) includes in its four families the Porcellanidae (porcelain crabs), and the small lobster-like crustaceans of the typical family Galatheidae. These latter have the body symmetrical, and the abdomen bent upon itself. The last pair of legs is slender, and is carried folded up close to the sides of the carapace. The last pair of abdominal appendages (uropods) is large, and, with the telson, forms a well-developed 'tail-fan.' The species of this family are distributed throughout the seas of the world; many live in deep water, and have extremely wide ranges. Perhaps the species commonest in Australian waters is *Munida subrugosa*, remarkable for its gregarious habits. As this species affords abundant food for the larger aquatic mammals, it has become known as

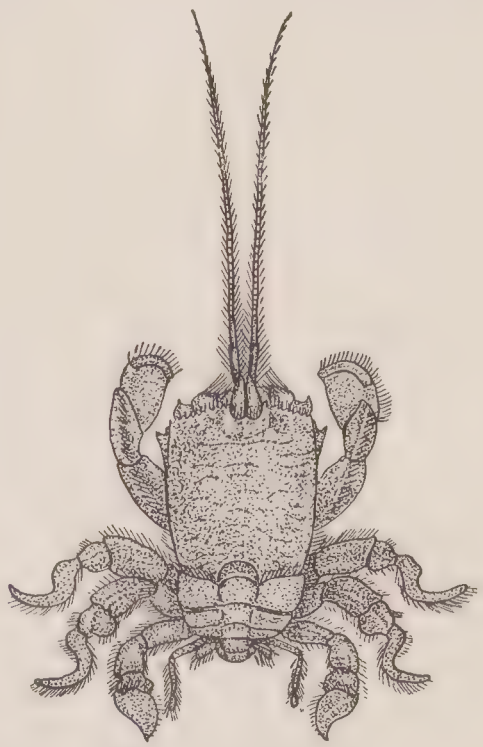
Miner Crab (from above, in burrow).

Munida subrugosa (slightly magnified).

'whales' food' in New Zealand, where it is particularly abundant. At times it has been observed congregating in millions on the surface of the sea, so that the water appears tinted with the red colour of the crustacean.

Porcelain crabs have a short and broad carapace without a prominent rostrum; although they are closely allied to the lobster-like Galatheidae, their habit of carrying the abdomen folded under the body gives them quite a 'true crab' appearance. Some species have all four pairs of legs visible, though the last pair is folded up close to the sides of the carapace, as in the Galatheidae; others have only three pairs of legs visible, the last pair being hidden within the branchial chambers beneath the carapace. The family is abundantly represented along the whole length of our coast-line, particularly in the tropics. Some species are of comparatively large size, and are ornamented with striking colours. *Porcellana dispar*, a tiny reddish-coloured species with a wide distribution on the eastern, southern and western coasts, is commonly found beneath stones at low-tide mark in harbours and river estuaries.

In the small tribe Hippidea are included some small burrowing forms, found only in tropical and subtropical seas, which live in sand and have the feet flattened for digging. The carapace is generally smooth and more or less oval; as in the Porcellanidae, the abdomen is folded under the body, but not so completely as in the true crabs. The tribe includes two families, the Albuneidae and the Hippidae, both represented in our fauna. A typical member of the Hippidae is the Turtle Crab (*Hippa adactyla*), a frequenter of coral lagoons, where it burrows in the sand at the water-level. It is amazingly active, and can be procured only by suddenly dislodging the sand from the spot where one has been observed burrowing. When uncovered in this way, it must be immediately secured, or it will disappear like a flash beneath the surface again. The family Albuneidae also graces our shores with a typical member, the



Mole Crab (natural size).

Mole Crab (*Albunea symnista*) which burrows like the turtle crab, and is fairly common on estuarine beaches in the subtropical zones. While buried, it carries on respiration through a tube formed of two rows of stiff hairs along the edges of the long antennules or inner feelers. The carapace of the mole crab is squarer in front than that of the turtle crab. F.A.McN.

Heron, Emily Matilda (1845-1890), second daughter of Sir W. M. Manning (q.v.), was born in New South Wales in 1845, and at an early age began to write pleasant but not particularly distinctive verse, also contributing miscellaneous articles to the local newspapers over the pen-name 'Australie.' In 1873 she married Henry Heron, a local solicitor, and in 1877 published in London her one volume of verse—*The Balance of Pain*. She died at Sydney on 25 August 1890.

Herons, Egrets, and Bitterns, large, long-legged birds with long necks and bills,

belonging to the family Ardeidae and order Ardeiformes. The family is largely represented in Australia, where its members are usually called cranes; but the only true Australian crane is the native companion (q.v.).

By far the commonest member of the family throughout the continent and Tasmania is the White-fronted Heron (*Notophoyx novae-hollandiae*), generally known as 'blue crane.' The

White-necked Heron.

larger and handsomer White-necked Heron (*N. pacifica*) is also familiar in districts suited to its habits. Herons that are adorned with ornamental plumes during the breeding season (mostly white herons) are known as egrets. The plumes are largely used to adorn ladies' hats, and are known by milliners as 'ospreys' or 'aigrettes.' As the plumes only appear during the breeding season, the collection of them necessarily involves the starvation of the young birds, whose parents are slaughtered for the decoration of thoughtless or heartless women. In Australia and its dependencies the possession of egret feathers is now a misdemeanour, and their export or import is forbidden. There are signs that the protection thus afforded the birds is already leading to an increase in their numbers. The large White Egret (*Egretta alba*) is the commonest and most widespread species; the Lesser Egret (*E. garzetta*) is not uncommon in northern and eastern Australia. Egrets breed in 'heronries,' building their nests close together in trees growing in a swamp.

The Reef Heron (*Demigretta sacra*), a small species found all round the Australian coastline, is interesting for its dimorphic coloration. The common colour is very dark blackish-slate, the rarer variety being pure white, though not an albino; the latter is only found on our northern coasts, and does not extend far south of the Tropic of Capricorn.

The attractive Nankeen Night-heron (*Nycticorax caledonicus*) is fairly plentiful throughout Australia and Tasmania, and occurs also in the Malay Archipelago and New Caledonia. The adults are of a beautiful cinnamon colour, with a black patch on the head and two long, narrow, pure white plumes on the back of the neck;

Nankeen Night-heron.

the young birds retain their immature plumage (mottled brown and dirty white) for two years. These birds are mainly nocturnal in their habits, and spend the day roosting in trees, so that they often escape observation.

Bitterns are also largely nocturnal and hard to see; though their necks are long, they usually carry them retracted, so that the general appearance is much more compact than that of herons and egrets. When alarmed, however, they draw themselves out to their full length, with the bill pointing straight upwards, and remain rigid and motionless; in this attitude they are more inconspicuous than ever amongst the reeds which most of the species frequent. The largest of the bitterns is the Australian Bittern (*Botaurus poiciloptilus*), which makes a loud booming noise during the evening and night. Two other common swamp inhabitants are the Black Bittern (*Dupetor flavicollis*) and the Little Bittern (*Ixobrychus minutus*); the Mangrove Bittern (*Butorides stagnatilis*)—as its name implies—inhabits mangrove thickets wherever these trees occur on our coasts. W.B.A.

Herring Cale. See PARROT-FISH.

Herrings (Clupeiformes). A large number of herrings are known from Australian waters, but although some of them occur in vast shoals, very few are utilized as food. Pilchards (*Sardinia*), sprats (*Clupea*), and anchovies (*Engraulis*) occur on the south-eastern coasts of Australia and Tasmania in enormous numbers, but no systematic effort is made to utilize them commercially. In the tropics a number of herrings of the genus *Harengula* move in shoals throughout the year, and are so closely packed that a spear thrown into their midst will often impale several specimens together. In Torres Straits these fishes form a large portion of the natives' food-supply.

The coastal rivers of New South Wales are inhabited by a freshwater herring (*Potamalosa richmondia*) which reaches a length of 12 inches. It readily rises to a fly, and small specimens are excellent eating, though larger ones are very bony. The so-called bony bream (*Nematalosa*)

is another freshwater herring. The 'Yarra herring' of southern Victoria and northern Tasmania (*Prototroctes maraena*) is not a herring at all, but a grayling. See ANCHOVY, BONY BREAM, PILCHARD and SPRAT. A.R.McC.

Heterodendron, a genus of the family Sapindaceae, with 2 species, both endemic in Australia. *H. oleaefolium* (Western Rosewood) is a tall shrub (20-25 feet) with narrow, usually rigid leaves, and small flowers without petals. It is found chiefly inland, ranging across the continent, and is highly prized as a fodder-tree. Recent investigations have shown that large quantities of prussic acid may be obtained from the leaves; but systematic feeding experiments will be necessary before it can be definitely decided that the plant is fatal to stock. The seeds are eaten by emus and by the aborigines. The timber is of a yellowish colour, hard and heavy. *H. diversifolium*, a shrub with very variable foliage, extends from New South Wales to Queensland.

Hibbertia. See DILLENIACEAE.

Hibiscus, a large genus of the family Malvaceae, consisting of herbs, shrubs or trees whose leaves are frequently coated with star-like hairs. Its habitat is chiefly tropical, and of the 40 species indigenous to Australia, which range right across the continent, only one (*H. Kriechauffii*) is found in Victoria. The flowers are usually large and showy, with petals deepening in colour towards the base. *H. heterophyllus*, which ranges from New South Wales to Queensland, is known as the 'green kurrajong.' Its mucilaginous leaves are greedily eaten by stock; the aborigines also eat leaves and roots without any preparation. It has a pale-coloured, smooth, tough wood, suitable for musical instruments, as it is a good conductor of sound. The fibre, which is white, strong and of fine texture, the aborigines use after maceration for making dilly-bags. *H. Trionum* (Bladder Hibiscus) is so called from the inflation of the membranous calyx, which enlarges as the fruit matures. It is a common weed in most tropical countries, though also grown as an ornamental garden plant. *H. tiliaceus* (Cotton-tree) is found from New South Wales to northern Australia, as well as in the Pacific islands. It has a beautifully marked, easily worked wood, resembling that of pollard oak. Its bark, which abounds in mucilage, provides sustenance for South Sea islanders when the bread-fruit crop fails. The aborigines of central Queensland prize the roots as a food, and in times of scarcity eat the tops, which taste like sorrel. The bark fibre they use for nets and fishing lines. In Fiji the bark is used to make the waist-band (liku) of the women. *H. splendens* is a highly ornamental shrub, with flesh-pink flowers, frequently cultivated.

Hickory. See ACACIA.

Hicksbeachia, a genus of the family Proteaceae; the single species is endemic in eastern Australia. The corolla is regular, tube straight, the segments soon parting; stamens inserted on the corolla lobes; fruit a nut. *H. pinnatifolia* (Monkey Nut) is a tall shrub or slender tree, with an edible fruit, the favourite food of the ring-tailed opossum. Pinky-red when ripe, it has an acorn-like flavour resembling that of the Queensland Nut (*Macadamia ternifolia*); but the shell is much softer.

Higgins, HENRY BOURNES, born at Newton Ards in Ireland in 1851, and educated at Newry and the university of Melbourne (B.A., 1874; M.A., 1875; LL.B., 1875), migrated to Australia in 1870, was called to the Victorian bar in 1876, and admitted to the English bar from the Inner Temple in 1886. In 1887 he was leader of the equity bar in Victoria. Entering politics in 1894 as member for Geelong, he made his mark during the next few years as chairman of a royal commission on legal procedure (1897-9) and as a member of the judiciary committee of the federal convention of 1897-8. He was not, however, a supporter of the convention's proposed constitution, considering it over-rigid; the senate, he thought, was constituted on a wrong basis, the machinery for overcoming deadlocks was inadequate, and the determination to leave Australia's railways in the hands of the several States was erroneous and might be disastrous. He consequently acted with the Victorian Labour party in its attempts to throw out the federation bill. In 1901, however, as soon as federation was an accomplished fact, he entered the federal parliament as member for Northern Melbourne, and in the second parliament became attorney-general in J. C. Watson's Labour ministry of 1904, although refusing to join the party. On 18 October 1906 Higgins was made a justice of the high court with the special duty (in which he succeeded Judge O'Connor) of presiding over the federal court of conciliation and arbitration. His work in this position—which he afterwards described in three articles in the *Harvard Law Review* (Nov. 1915, Jan. 1919, and Dec. 1920)—was of great importance, as it fell to him to lay down the principles on which federal arbitration awards must be based (for these see INDUSTRIAL LAW). His first decision—in what is known as the 'Harvester' case—gave a key to his interpretation of the law. A good deal hung on it. If he decided that the remuneration of employees of firms manufacturing harvesters was 'fair and reasonable,' the excise duty on harvesters would be considerably diminished. He at once laid down the doctrine of the 'basic wage,' fixing 42s. per week as the lowest pay that would in Melbourne support an unskilled labourer in frugal comfort, and declined to certify that any lower wages were 'fair and reasonable.' The amount of the basic wage has been frequently altered to meet the altered purchasing power of money; but the principle is now generally accepted. In 1922, considering that the powers of the arbitration court were unduly diminished by certain legislation, he resigned the presidency of the court, retaining, however, his seat on the high court bench. Apart from politics and judicial work his chief hobbies have been literature and physical culture. He has been a member of the council of the university of Melbourne since 1887, and in 1904 founded a scholarship at the university for the study of poetry.

High Court, The. See JUDICIARY.

Higinbotham, GEORGE (1826-1892), born in Dublin on 19 April 1826 and educated at Trinity College, Dublin (B.A., 1848; M.A., 1853) in 1847 went to London to study law, earned his living as a reporter for the *Morning Chronicle*, and was called to the bar on 6 June 1853. Early in 1854 he migrated to Melbourne and on 27 March was admitted to the Victorian bar. He continued to combine journalism with law, writing occasionally for the *Herald* and at the same time practising his profession. In 1856 he dropped his practice to become editor

of the *Argus* (in succession to Edward Wilson), but in 1859 he resigned the editorship and resumed his profession. In May 1861 he entered political life as member for Brighton in the assembly, voting as an independent Liberal; defeated at that year's general election, he regained the seat in April 1862 and held it for nine years. He opposed the land act of 1862, and the electoral bill. On 27 June 1863 he became attorney-general in the McCulloch ministry, and during the fierce struggle (1865-8) between the two houses over finance bills and the Darling grant was the most popular man in Victoria. On 4 September 1866 he was appointed chairman of the education commission. On 6 May 1868 the ministry resigned; the Sladen ministry held office for two months, and when in July the McCulloch ministry was reconstructed Higinbotham declined the post of attorney-general on the ground that the colony was being governed by instructions from Downing Street. He took, however, the unsalaried position of vice-president of the board of lands and works, but resigned that on 1 February 1869, and never again held office. In 1871 he lost his seat for Brighton to Thomas Bent (q.v.), a local market-gardener who was really more representative of the constituency as a whole. For the next two years he confined himself to practice at the bar, but in May 1873, returned to the assembly as member for the East Bourke boroughs; parliament was, however, in perpetual turmoil, which in 1875-6 culminated in a gigantic 'stonewall,' and Higinbotham in January 1876 left politics for ever, declaring in his last speech 'We are all like common scolds in this House.' On 19 July 1880, he was, to the satisfaction of the community, appointed a puisne judge of the supreme court of Victoria, and in September 1886 succeeded Sir William Stawell as chief justice. During his tenure of this office an important constitutional question arose. Sir W. Stawell had been appointed lieutenant-governor, a position usually held by the chief justice for the time being. When he found it necessary for reasons of health to resign this post also, Higinbotham was his natural successor. But for many years he had been fighting the colonial office, which in his opinion exercised far too much control over Australian affairs, and interfered with the working of responsible government by its advice and instructions to the governor of the day. Before, therefore, he could himself be made acting-governor it was necessary to clear up the points in dispute; and, though the colonial office made many concessions, it remained too stiff-necked for him. When Sir H. Loch during his term as governor wished to leave the colony for a time, the ex-governor of South Australia was put in as his locum tenens: when the situation recurred at the end of 1892, it was decided to install the senior puisne judge, Hartley Williams, over Higinbotham's head. But on 31 December of that year Higinbotham died, and his successor John Madden was made acting-governor without any trouble.

Higinbotham was undoubtedly a great man, one of the very few great men Australia has cherished. But the vehemence with which he urged his opinions alienated many of his more notable contemporaries, and his entire lack of the power to compromise made him comparatively ineffective as a politician. In a crisis he was abnormally powerful: H. Gyles Turner, no great admirer of his opinions, describes him as 'a man who by his intensity of character, the transparent conscientiousness of his convictions, and his burning oratory, exercised a sway over the House which in Victoria has never been equalled.' In less exciting times, although his devotion to work and his absolute unselfishness were recognized and admired, his influence suffered a gradual decay. No greater contrast could be conceived than that between the sarcastic bitterness of his public invective and the urbane courtesy of his private life: if he could have brought himself to treat the colonial office as he in private treated his strongest political opponents, he might have in the sixties brought about those constitutional reforms within the Empire that even in 1911 were scarcely effected. But his references to 'ignorant and transient' ministers and to colonial self-government as being really 'government by a person named Rogers' (the then chief clerk at the colonial office), though scarcely overstatements, were injudicious, and rankled for many years. On the bench his defects hardly showed at all. He has been denied the name of great lawyer because 'he could not lose sight of the object in the instrument'—an objection which at any rate cannot deny him the name of great judge. But twice in his life he effected a consolidation of Victorian statute law—as attorney-general in 1864-5, and as chief justice in 1888-90; and for the second task he received on 16 December 1890 addresses of thanks from both houses of the legislature. He received no decorations or titles, because he would accept none from any authority except those of his own colony—rewards for local services, he said, should emanate from a local source.

Hilder, Jesse Jewhurst (1881-1916), born at Toowoomba in Queensland on 23 July 1881 and educated at the Brisbane boys' grammar school, in 1898 entered the service of the Bank of New South Wales, working in its branches at Brisbane, Goulburn, Bega, and Waverley. While employed at Bega he developed a taste for painting, and when removed to Waverley (a suburb of Sydney) met Fred Leist and was taken in 1906 to Julian Ashton (q.v.), at whose art classes he learnt the technique which his earlier self-taught work had lacked. In the same year it was discovered that he was phthisical, and in 1907 he was again removed to Wyalong on the western plain, from which place he sent 21 water-colour sketches to the exhibition of the Society of Artists. The work made a sensation, every picture was sold—an achievement repeated with the 14 he sent to the Society's exhibition of 1908—and in 1909 he left the bank's employ and devoted himself to art. The rest of his life was spent mainly at Epping, Ryde and Hornsby on the heights north-west of Sydney, from which excursions to the Hawkesbury and Lake Macquarie were easily made; Dora Creek, which runs into Lake Macquarie, was a favourite sketching-ground. He died at Hornsby on 10 April 1916. During the latter part of his life he was prolific as an artist, and was able to live comfortably on the proceeds of private sales; but after his death the value of his work was far better appreciated, and pictures for which he had been paid five or six guineas were re-sold for a hundred guineas or more. Slight as some of his pictures may appear, they have the breadth and vigour of large paintings: his compositions are never strained, and his handling is never affected.

W.M.

Hill, CLEMENT, born at Adelaide on 18 March 1877 and educated at St. Peter's College in that city, entered first-class cricket when only 16, and two years later made a century playing for his colony against Stoddart's team. In 1896 he went to England with an Australian team, and was a member of every succeeding team that visited England until 1905; he also played in every test match in Australia between 1897 and 1912. In test matches he has made 3401 runs, an average of 39.1. Of his 45 centuries four were made in tests. On Australian wickets he ranks as the greatest left-hand batsman ever seen. The highest score made in Sheffield shield contests stands to his credit—365 for South Australia against New South Wales. See CRICKET.

Hindmarsh, SIR JOHN (1782-1860), entered the navy in 1793, and served in the *Bellerophon* in the action of 1 June 1794 and at the battle of the Nile. In this battle the *Bellerophon,* while anchored, was dismasted by the fire of the French flagship *L'Orient* and entangled in her rigging just as she burst into flames (it will be remembered that the boy Casabianca was aboard her, though, Mrs. Hemans notwithstanding, he did not perish in her). At the moment young Hindmarsh was the only officer on the *Bellerophon's* deck; he ordered the cable to be cut and a spritsail to be set, and thus manoeuvred the ship out of danger—a service for which Nelson thanked him, and the ship's officers gave him a sword. Nelson in 1803 summoned him to join the *Victory,* and just before Trafalgar made him lieutenant of the *Phoebe,* in which he took part in that victory. From 1793 to 1813, when he returned to England invalided, his war service was almost continuous, the Nile (where he lost an eye) and Trafalgar being only the two best-known of the many engagements in which he took part. He was promoted commander in 1815 and captain in 1830, and in 1834 was sent to Alexandria to take high command in the Egyptian navy. This appointment was of very short duration, for in 1835 the colonization commissioners for South Australia, being unable to get Colonel Napier on their own terms as first governor, nominated Hindmarsh; he was accepted by the British government, made a Knight of Hanover by the king, and sailed in H.M.S. *Buffalo,* reaching South Australia on 28 December 1836 and there and then officially proclaiming and establishing the province under the old eucalyptus at Holdfast Bay. Almost immediately sharp differences occurred between him (who, as governor, was of course a king's official) and the commissioner for crown lands, J. H. Fisher (q.v.), who represented the colonization commissioners. Hindmarsh (who would have preferred Port Lincoln as the capital) wanted Adelaide to be sited much nearer the shores of the gulf—a wish not unnatural in a seaman, but unpalatable both to the surveyor-general and to most of the settlers; nor was this the only cause of quarrel. In the end it was decided to recall both Hindmarsh and Fisher, and to invest the next governor with full powers in every branch of jurisdiction. Hindmarsh accordingly left the colony in July 1838, and in 1840 was made lieutenant-governor of Heligoland, and given his step to rear-admiral in 1856. He retired from service in 1857, and died on 31 July 1860. (K.H., 1836.)

Hobart capital of the State of Tasmania, lies in 42° 53′ S. lat., 147° 21′ E. long., on the western shore of the Derwent River about 12 miles from the sea. 'Hobart' was the name given by Lieutenant Bowen to his settlement at Risdon in 1803; but Collins, when in 1804 he removed the settlement to the western shore, gave it the name of Hobart Town, and this remained the official name (though in the forties the colonial office favoured 'Hobarton') until in 1881 an act of the Tasmanian legislature restored the abbreviation 'Hobart.' Colonel Davey in 1813 had attempted to make this change, but was sharply rebuked by Macquarie. The story of the settlement up to the death of Collins in 1810 will be found under TASMANIA. At that date the site of the town had been definitely fixed, but not laid out, and the houses (which in 1812 numbered about 150) were scattered irregularly in all directions. After his visit to the settlement in 1811 Macquarie appointed surveyors to draw up town-plans, and himself named the principal streets. In 1813, under instructions from the colonial office, he rescinded the regulations which prohibited masters of vessels from discharging any cargo at minor Australian settlements without first touching at Port Jackson, and thus made it possible for the town to develop into a commercial port; it remained closed against the liquor traffic, however, until 31 December 1814, when the contract for the building of a hospital at Sydney came to an end—under this contract the builders had been given a monopoly of the liquor traffic in the colony (which then included Tasmania) for four years, and the loss of revenue caused by it prevented Davey from erecting several much-needed public buildings. There was no marked development in the town until Colonel Sorell took over the administration in 1817. Macquarie, who made a second visit to the town in 1821, was much impressed by the improvements effected under Sorell's administration. The population had increased to 2700; the irregularly-placed huts and cottages of 1811 had given way to substantial houses (421 in number) fronting regular streets; a government house, military barracks, and a gaol had been erected, and a signal, post and telegraph station established on Mount Wilson; a hospital, convict barracks, and Anglican church were under construction; four water-mills were in operation on the Hobart rivulet; to accommodate shipping a substantial pier was being constructed in Sullivan's Cove. The whaling industry was already important, and had encouraged shipbuilding enterprise. Indeed, by 1819 business had extended so much that the bench of magistrates and the lieutenant-governor's court could no longer deal with the many disputes, and to obviate the expense of frequent reference to Sydney the supreme court judge of New South Wales undertook to hold an annual circuit court in Hobart. The Van Diemen's Land Bank was established in 1823.

When in 1825 Tasmania was constituted a separate colony, there was considerable opposition to the retention of Hobart as the seat of government. On 22 April 1826 Colonel Arthur informed the colonial office that from an administrative point of view the site had many disadvantages. It could only be reached from the north—where settlement was rapidly extending—by a ferry service across the river which was exposed to strong winds and currents, occasioning much delay and expense and no inconsiderable danger to persons and property. To this remoteness Arthur attributed much of the difficulty experienced in suppressing bushranging. Moreover, he considered it desirable to

remove farther inland the mass of convicts that must necessarily accumulate at the chief settlement, so as to minimize their opportunities of escape. Arthur recommended Brighton in the Jordan valley, a site favoured by Commissioner Bigge during his investigations in 1820; the legislative council, however, preferred New Norfolk as being easy of access from inland and in direct connection by water with Hobart—this was an important consideration, as Hobart would remain the principal port of the colony; the government surveyors were not unanimous, but pointed out disadvantages in the site of New Norfolk. Opinion being so divided, Arthur determined the issue on the basis of cost; he adhered to the opinion that Hobart was totally unsuited to be the capital, but it was clear that certain public buildings which were required without delay could be erected more cheaply there than anywhere else. The question had already been decided when the colonial office forbade any change.

By 1827 the population of Hobart had increased to 5000. At that time, according to Arthur, British manufactured goods and European wines were imported in exchange for wool, whale oil, sealskins, extract of mimosa, hides, etc.; from China and the East Indies, tea, rice, spices, piece-goods, and silks were imported; from the Cape of Good Hope, wines; from the Brazils, tobacco; and from the Isle of France, sugar. There was also a steady local trade with Port Jackson. The total declared values of imports at Hobart in 1826 were £99,747 and of exports £44,498.

From the thirties onwards the growth of the capital was conditioned by the development of the colony. The town was governed by commissioners from 1846 until 1852—when a municipal council was constituted—and was incorporated as a city in 1857. Local government brought in its train civic improvements. In 1857 gas-lighting was installed; in 1860 the works installed in 1831 for the distribution of water from the Hobart rivulet were taken over by the municipality and extended; the installation of a sewerage system was delayed until 1903. Since the completion of the Great Lake hydro-electric scheme as a national undertaking (see HYDRO-ELECTRIC DEVELOPMENTS) electricity for lighting and power purposes has been supplied to the city. The zinc-refining works at Risdon a few miles away are among the largest of their kind in the world.

The private schools of Hobart, which have been from the first an important and notable influence in the life of the city, are discussed under SCHOOLS: public education is dealt with under EDUCATION, PUBLIC. The city's newspaper press dates from 1816, when the *Hobart Town Gazette* was published under official auspices; for two earlier attempts to establish local newspapers—the *Derwent Star* in 1810 and the *Van Diemen's Land Gazette* in 1814—see PRESS. A mechanics' institute was founded in 1827; in 1849 a subscription library was established with government assistance, and in 1850 was converted into a public library. The Royal Society of Tasmania—founded in 1838 by Sir John Franklin as 'The Tasmanian Society'—controlled the museum (established in 1848) and the botanical gardens until 1885, when they were taken over by the government. The art gallery was opened in 1889, and the university of Tasmania founded in 1890. The population of the city on 31 December 1923 was 55,243, just a quarter of the total population of the State.

Hobby, THOMAS (1770?-1833), born in England about 1770, was on 9 November 1797 commissioned lieutenant in the New South Wales Corps, and reached the colony in 1798. After doing duty at Sydney for nearly 12 months he was made commandant of the Hawkesbury district, and in December was granted two 100-acre farms at Mulgrave. He promptly resigned his commission, intending to settle down as a sheep-breeder, but repented this action and was allowed to remain in the corps. In 1801 he had 70 acres under crop and was running 140 sheep and 200 goats. In 1803 he was in trouble with Governor King over the circulation of some lampoons, but the British government for the sake of harmony overlooked the irregularity. Before his trial on this charge he had (in March 1803) gone on half-pay, and thenceforth his name did not appear in corps returns until 1807. His farm holdings varied remarkably; at the beginning of 1804 he held 500 acres, at the end of 1805 only 280, yet his flock of 320 sheep did not alter in size. On 1 January 1808 he with other settlers in the Hawkesbury district signed a eulogistic address to Bligh, but before the end of the month had signed another congratulating Johnston on the success of the mutiny, and in March 1809 Bligh included him in a list of the chief mutineers; in 1810 he signed a loyal address to Macquarie. His name invariably comes second on the list of Hawkesbury signatories, and he probably went on quietly all the time with his farming and signed anything put before him to avoid quarrels with his neighbours. Little more is known of him. In 1812 he owed the government nearly £200; in 1811-27 he was assistant coroner at Castlereagh; and he died at Penrith on 8 January 1833. The existence of Hobby's Yards near Bathurst may indicate that he had property in that district also.

Hobson, WILLIAM (1793-1842), born in England in 1793, entered the navy in 1811 (lieutenant, 1813; commander, 1824; captain, 1828) and saw active service in the West Indies in 1822-3 against the piratical bands that infested those regions. By one of these he was captured, but his reputation for courage and generosity induced them to set him free. In 1835 he was appointed to H.M.S. *Rattlesnake*, and in 1836 sent to the Australian station, where Bourke found him very useful. In September he sailed from Port Jackson for Port Phillip with Captain Lonsdale (whom Bourke had appointed police magistrate of the new settlement), and while in Port Phillip surveyed and buoyed Hobson's Bay—which was named after him—and surveyed a good deal of the more open waters towards Sorrento. Returning to Sydney, he in February 1837 took Bourke himself to Port Phillip (which was reached on 4 March), and during this visit completed three charts which greatly facilitated the navigation of the port for many years. Later in the year, hearing from James Busby of internecine wars in New Zealand, Bourke sent off Hobson to protect British interests there, and asked him to report on the whole situation. To the resulting report, and to Bourke's high praise of both it and its author, Hobson owed his appointment on 13 July 1839 as lieutenant-governor of New Zealand under the governor of New South Wales—a post which on 3 May 1841 was converted into an independent governorship. His work in New

Zealand, which was of great value—including the conclusion of the famous treaty of Waitangi—is sufficiently described under NEW ZEALAND: it was unfortunately cut short by his death on 10 September 1842, following immediately on a paralytic stroke, but undoubtedly hastened by the strain of administration with an empty treasury and the vindictive opposition of the New Zealand Company. His epitaph was written by a Maori chief in an appeal to the Queen:—'My subject is a Governor for us the Maoris, and for the Pakeha in this island. .
Let him be a good man, as the Governor who has just died.'

Hoddle, ROBERT (1794-1881), born in London in August 1794, was made a military surveyor and draughtsman when only 18 years old, and employed in the trigonometrical survey of Britain. In 1817 he went on half-pay, and in 1821 proceeded to the Cape Colony as assistant engineer and was employed there on military surveys. In the hope of bettering his position he moved in 1823 to New South Wales, where under the rule of Sir Thomas Brisbane surveyors were much needed, and on 9 September was appointed at Oxley's request assistant surveyor in the Sydney office. Oxley, who was just starting on his famous journey to Port Curtis (during which he discovered the Brisbane River), sent Hoddle on 26 September to survey the newly discovered Bell's line of road over the Blue Mountains north of the Grose valley, a task which was completed by 11 November. During 1824 he was at work for the most part in the Goulburn and Bathurst districts, but accompanied Oxley—who had a high opinion of him—to Moreton Bay in September-October and surveyed and mapped the shores of the bay. For the next twelve years he worked steadily in one or other of the districts then being settled west and south of Sydney, laying out the townships of Liverpool (1827), Campbelltown (1827), and Goulburn (1832). On 1 July 1826 Darling made him assistant surveyor on the parliamentary establishment, and three weeks later eulogized him as 'one of the most competent men in the department'—an opinion shared by Oxley. On 7 August 1828, being then the senior assistant in the office, he was made acting deputy surveyor-general, and on 28 October was given the definite status of surveyor—which apparently made the acting appointment unnecessary; this was fortunate, because in April 1829 the colonial office refused to confirm it, and sent out S. A. Perry (q.v.) to fill the post. The decision is unexplained, but may be due to the fact that Hoddle was a protégé of a Whig nobleman, Lord Frederick Cavendish, and therefore unacceptable to the Tory minister of the time. The work by which he is chiefly remembered is the definitive laying out in 1837 of the township at Melbourne. On 3 March of that year Bourke made him senior surveyor at Port Phillip, and on 1 May gave him charge of the town site: on 1 June, by Lonsdale's orders, he acted as auctioneer at the first land-sale there. He had already (on 7 May) been made a commissioner of crown lands for New South Wales. The rest of his life he spent in the Port Phillip district. When Victoria was separated from the parent colony, Hoddle on 15 July 1851 was made its first surveyor-general: but in 1856 he retired from active service, and died at Melbourne on 23 October 1881.

Hodgkinson, W. O. See EXPLORATION BY LAND.

Hodgson, SIR ARTHUR (1818-1902), born at Rickmansworth in Hertfordshire on 29 June 1818, was sent to Eton when ten years old, but left it to join the navy as a midshipman (1833-7) in H.M.S. *Canopus,* left the service to spend a year at Cambridge, and in December 1838 migrated to New South Wales, where he was soon joined by his brother Pemberton Hodgson. In 1839, according to H. S. Russell (*Genesis of Queensland*), he owned Cashiobury station in New England, but sold it in 1840 and, on the advice of Patrick Leslie (the pioneer of the Darling Downs) travelled his stock to the Downs through Cunningham's Gap and took up a station near Toowoomba which he named Etonvale. In July 1856 he was appointed general superintendent of the Australian Agricultural Company (q.v.), and in 1858 was elected by the constituency of Clarence and Darling Downs to the New South Wales legislative assembly, becoming in 1859—when Queensland was made a separate colony, and his old constituency disappeared—member for Newcastle. In 1861 he entered the Queensland assembly as member for the Warrego, during the same year resigning his position with the Australian Agricultural Company and returning to the management of his own properties. In 1868 he joined the Mackenzie ministry, just before its fall, as minister for public works (10 September to 25 November), and was colonial secretary in the Lilley ministry which followed (28 January to 10 November 1869); he resigned in order to visit England, and in 1874 settled at Clopton near Stratford-on-Avon and spent the rest of his life as a territorial magnate. He died on 24 December 1902.

From first to last Hodgson was a squatter, with squatting interests at heart. When the southern colonies were in the thick of the anti-transportation agitation, he led a Darling Downs movement for the separation of Moreton Bay and its northern districts and the admission of 'exiles' to provide labour for the pastoralists, and came into collision with Dr. Lang thereanent; in 1854, indeed, the rivals contested an election for the county of Stanley (i.e. the Brisbane district) and Hodgson was elected, but was unseated by the elections and qualifications committee of the assembly. He favoured the establishment of a colonial peerage, and opposed the later and successful movement for Queensland separation. But as a representative of his colony in Europe he was in the right place, and did good work as commissioner at the London international exhibition of 1862, the Paris exhibitions of 1867 and 1878, and the Vienna exhibition of 1874. (C.M.G., 1878; K.C.M.G., 1886.)

His brother CHRISTOPHER PEMBERTON HODGSON spent some years at Etonvale, and was a member of Leichhardt's first expedition (1844-5), but at Leichhardt's request returned to Brisbane about a month after starting, as provisions were running short and the party's numbers had to be reduced. As a rumour reached Sydney that the expedition had been massacred, Hodgson in July 1845 started with a relief party to ascertain the truth, and followed Leichhardt's tracks for seven weeks through scrub and ranges into open plain country, returning with the assurance that the massacre story was baseless. Hodgson, who was apparently of a type unsuited to the colonial life of those days, then returned to England, and published his *Reminiscences of Australia* (London, 1846).

Holder, Sir Frederick William (1850-1909), born at Happy Valley in South Australia on 12 May 1850 and educated at St. Peter's College, Adelaide, became a state schoolmaster under the education department and afterwards editor and proprietor of the *Burra Record*. In April 1887 he was elected to the legislative assembly for Burra, and held the seat till 1901. In 1887 he was a member of the royal commission on the land laws; in 1888 he was made chairman of the barrier trade committee, and in 1890 chairman of the royal commission on intercolonial free trade. In 1889-90 he was treasurer in the Cockburn ministry, then became leader of the opposition, and on 21 June 1892 formed a short-lived ministry of his own. In 1893 he joined his former opponent C. C. Kingston as commissioner of public works (June 1893 to April 1894) and treasurer (April 1894 to December 1899). On 1 December 1899 the Kingston ministry was defeated, but within eight days Holder had formed his second administration, which lasted from 8 December 1899 to 15 May 1901. He took a prominent part in the movement for federation, and was a member of the 1897-8 convention. In May 1901 he was elected to represent South Australia in the federal parliament, and was unanimously elected speaker of the house of representatives, holding the position till his death. He served in the volunteer military forces from 1858 to 1899.

His death was tragic. During the stormy sessions of the house that followed the 'fusion' of 1909 between the parties led by Alfred Deakin and Joseph Cook, which ousted the Labour ministry from office, Holder spent weary and troubled hours in the chair attempting to control the frequent outbursts of political passion. Early in the morning of 23 July, the house having gone into committee during an all-night sitting, he was resting on a back bench when a storm of greater fury than usual threw the house into confusion; struggling to his feet in order to take the chair again if summoned, he fell in a fit and died almost immediately. The house, shocked beyond measure, adjourned at once, and at later sessions kept within bounds. (K.C.M.G., 1902.)

Holothuria. See Echinodermata.

Holroyd, Arthur Todd (1806-1887), born in London on 1 December 1806 and educated at Ripon, Christ's College, Cambridge (M.B., 1832) and the university of Edinburgh (M.B., 1830), abandoned medicine after a year's practice in London and entered Lincoln's Inn as a law-student. The years from 1835 to 1838 he spent mainly in travel through Egypt, the Sudan, and Syria, which resulted in a spirited protest against the operations of the Egyptian slave-trade; in 1841 he was called to the bar, in 1843 migrated to New Zealand, and in 1845 came to Sydney, and was admitted to the local bar in October of that year. Taking up politics, he represented Bathurst and Carcoar in the legislative council from 1851 to 1856, was re-elected by the same constituency to the new assembly in 1856-7 (during which time he was its chairman of committees), and after a short absence re-entered the assembly in 1861 as member for Parramatta. In the Martin ministry of 1863-5 he was minister for public works, resigning after an unsuccessful attack on his administration, and taking the mastership in equity (1866) and in lunacy (1879). During the latter year he acted for some time as a judge of the supreme court. Apart from his profession he was mainly interested in scientific matters, being a fellow of the London Zoological Society from its foundation in 1826, of the Linnean Society from 1829, and of the Royal Geographical Society from 1849. He died in Sydney on 15 June 1887.

Holroyd, Sir Edward Dundas (1828-1916), grandson of Sir G. S. Holroyd, a distinguished judge of the king's bench, was born at Wimbledon in Surrey on 25 January 1828, educated at Winchester and Trinity College, Cambridge (B.A., 1851; M.A., 1854), and called to the English bar on 6 June 1855. After three years' practice in London he migrated to Victoria in 1859, was admitted immediately to the Victorian, and in 1867 to the Tasmanian, bar, built up a successful practice on the equity side, took silk in 1879, and in 1881 succeeded Wilberforce Stephen as puisne judge of the Victorian supreme court. He retired from the bench in 1906 and died at St. Kilda on 5 January 1916. (Kt. Bach., 1903.)

Holt, Joseph (1756-1826), born in 1756 in county Wicklow, Ireland, in 1782 took a farm in the parish of Dirrelossery, and was appointed to several minor public offices in Wicklow and Wexford. He was a Protestant, and had no sympathy with the rebellion of 1798 until his landlord (with whom he had quarrelled) denounced him as among the disaffected, proceeded to his house with a detachment of yeomanry, and burnt it during his absence. Resentful and indignant, Holt in May 1798 joined the rebels, and for more than six months conducted a successful guerilla campaign within 30 miles of Dublin. Time, however, wore down the rebel army, and Holt with a price upon his head was a fugitive in the Wicklow mountains; he surrendered on 10 November and was sentenced to transportation to New South Wales. His enemies said that easy terms were granted him in return for information supplied to the Castle authorities, but the only justification for this assertion is that after being sentenced, and while awaiting transportation, he revealed the existence of a conspiracy of United Irishmen in the neighbourhood of Cork; this he afterwards denied, but evidence found among Lord Castlereagh's correspondence proves it. Accompanied by his wife and family (except a daughter who was left with friends in Ireland) Holt sailed in the *Minerva* on 24 August 1799 and arrived in New South Wales on 11 January 1800; among his fellow-prisoners were two captains in the British army (Alcock and St. Ledger), Henry Fulton, a Church of England clergyman, and Father Harold, a Roman Catholic priest, all of whom were implicated in the rebellion. William Cox, paymaster of the New South Wales Corps and founder of a well-known Sydney family, travelled in the same vessel, and through his intervention the rebels were treated with more consideration than the other prisoners.

On arrival Cox obtained permission to take Holt into his service as a farm superintendent, but the prisoner indignantly refused, considering himself merely an exile, and not in any way at the disposal of the government—a view in which Hunter coincided. Later on, however, Holt found that to live he must eat, and to eat, work, and on 22 January 1800 became manager of Cox's Brush Farm, near Ryde. On 5 September he was arrested under suspicion of being concerned in a conspiracy of Irish prisoners, but nothing was proved against him, and King restored him to liberty; he returned to the farm, and by good management considerably improved

the estate, which Cox on his advice enlarged by the purchase of land from adjoining owners. Holt also bought land for himself; his first farm was about three-quarters of a mile from the Cox estate, and later on he bought adjoining property. On 5 March 1804 another attempt at rebellion was made, which culminated in a fight on Castle Hill near Parramatta; the rebels were quickly put to flight, and 12 of their ringleaders subsequently hanged. Some of them falsely accused Holt of participation in the crime, and he was improperly committed to prison by Atkins the judge-advocate; always arrogant, he defied Atkins and all his works, and in May King exiled him to Norfolk Island. In November 1805 he was permitted to return to New South Wales, and embarked in the *Sydney*, which put in at the Derwent River in Tasmania on 2 December. Here he met Collins, who was friendly and asked him to report on the value of land along the Derwent; after three weeks' investigation he reported that, instead of 35 or 40 bushels to the acre, farmers would be lucky if they got 20, and even this yield could only be made fit for use with great difficulty, as it was infected with smut. Collins now asked Holt to take charge of the government farms, and he would have done so had not his wife (who had not been sent to Norfolk Island) preferred to remain in Sydney. He therefore returned to Port Jackson on 5 February 1806, and found his affairs in good order; but not long after his return he took it into his head to set up a still. He was caught and brought before Major Abbott, but was let off on bonds being entered into, and did not offend again.

During the Bligh mutiny he seems to have kept clear of both parties. On 1 January 1811 good conduct brought him a free pardon; he at once put up his farms for sale, secured a passage in the *Isabella*, and sailed for England on 4 December 1812—among his fellow passengers was Sir Henry Browne Hayes (q.v.). On 7 February 1813, when off the Falkland Islands, the ship struck a reef, and all on board were landed with difficulty on Eagle Island. Some of the crew went off in the long-boat to look for help, and at Buenos Ayres found H.M.S. *Nancy* which was despatched to the rescue. Meanwhile on 4 April the American brig *Nannen* put in at the island, and the castaways arranged with her master to take them off, in return for the wreck and what he could get out of it. On 12 May, just when the Americans were loading their vessel with the salved cargo, the *Nancy* arrived and, as Britain was then at war with the United States, made the *Nannen's* crew prisoners of war, and took them and the castaways to Rio de Janeiro. Holt arrived in Dublin on 5 April 1814, started a hotel, found it a losing investment, and at the end of a year gave it up, using what remained of his capital to build some houses. He died in poor circumstances in 1826 at the age of 71, regretting that he had left New South Wales.

The Memoirs of Joseph Holt, edited from the original MS. in the possession of Sir William Betham by T. Crofton Croker, and published by Colburn (London, 1838), is the best authority for his life.

Homalanthus, a small genus of the family Euphorbiaceae, containing two species, both indigenous to Australia and ranging from Victoria into northern Australia. *H. populifolius* is a tall shrub with large, almost triangular leaves, which often turn red. The diminutive, unisexual flowers are borne on slender spikes; capsule greyish-green, opening tardily; seeds enveloped in a fleshy coat (*arillus*). The shrub is known as 'native poplar,' from the shape of its leaves—which are, however, much larger than those of the European poplar. It is also called 'Bulli poison-bush,' and is reputed to be poisonous to stock, though feeding experiments with calves, covering a lengthy period, have been conducted without any injurious effects.

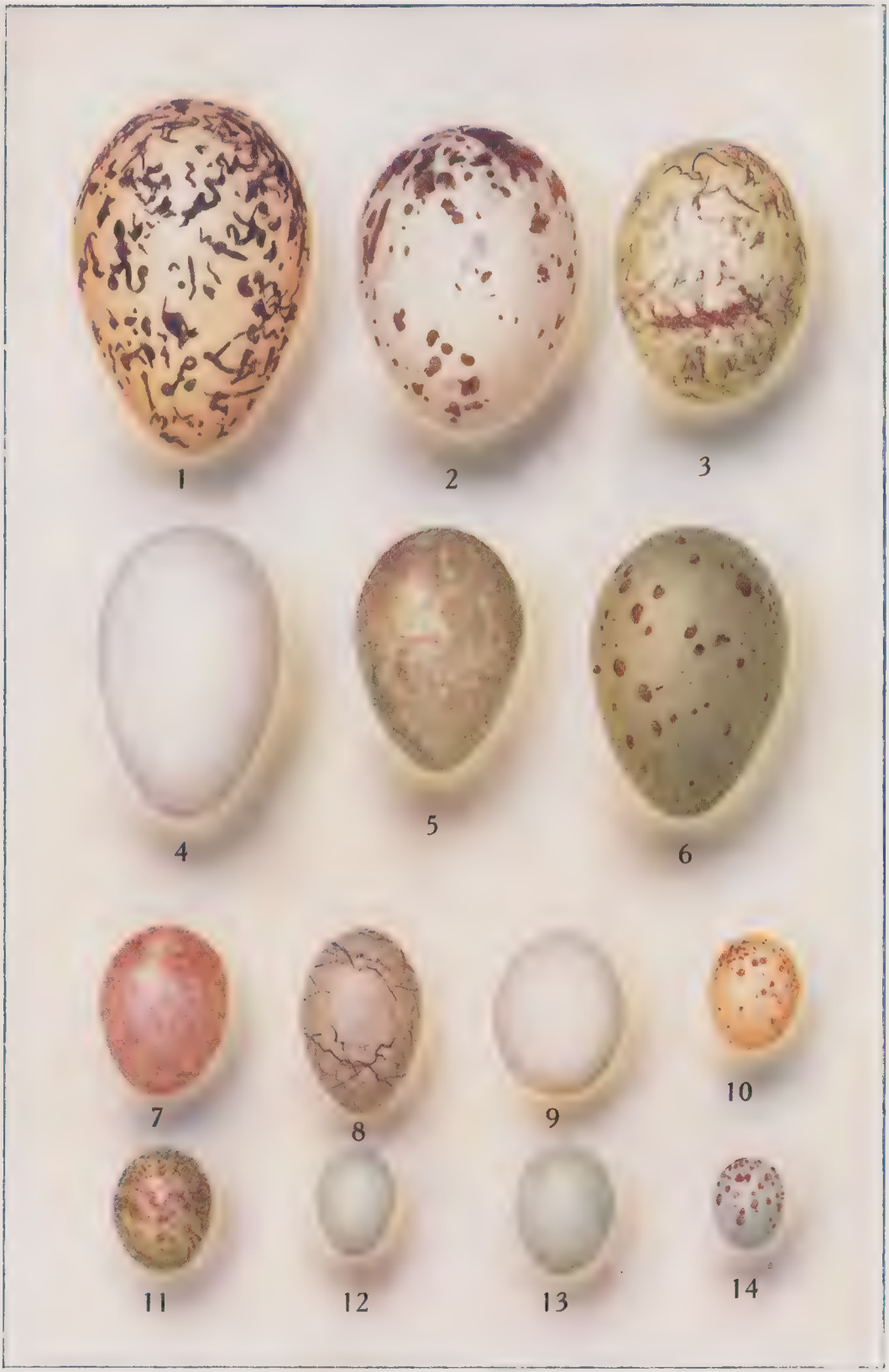
Honey-eaters, a family of perching birds (Meliphagidae), characteristic of the Australian region, to which it is confined. The numerous species range from Australia and Tasmania through the Papuan islands to Timor, Lombok, and Celebes, and eastwards to New Caledonia, New Zealand, and the Chatham, Samoan, and Hawaiian islands.

Members of the family vary in size from the little bloodbird, only about four inches long, to the wattle-birds, friar-birds and New Zealand parson-bird, which measure from 12 to 15 inches. In respect of coloration, though a large number are more or less brown or green, many are adorned with black, white, yellow, and red; several have brightly-coloured patches of bare skin on the head, or fleshy wattles on the cheeks. The bill varies greatly in length, being quite short in the blackcaps (*Melithreptus*) and long and slender in the spinebills (*Acanthorhynchus*); but it is always somewhat curved. The distinctive feature of the family is the protractile tongue; this is divided into two branches, each split up into numerous stiff horny fibres that form a brush. It is used for obtaining honey from flowers, as this forms the principal article of diet of many species; it is supplemented in most cases by insects, and in some by fruits.

Honey-eaters are generally lively birds, hopping and fluttering actively about flowering trees and bushes, or climbing among the twigs. Most of them utter melodious calls, but some of the larger species have distinctly harsh, discordant cries. A few are quite pleasing songsters. The nests are open, cup-shaped structures, placed in trees or bushes—usually in forks, but sometimes suspended by the rims. They are variously composed of grass or bark, often interwoven with cobwebs and lined with finer materials, hair or wool. The eggs, sometimes white, are usually somewhat pink or buff in ground-colour, and are almost invariably spotted with reddish-brown or grey.

About 70 species of honey-eaters occur in Australia and Tasmania. The majority are merely known as honey-eaters with some qualifying adjective, but the larger forms are called miners, friar-birds and wattle-birds. These are dealt with in separate articles. The remaining smaller forms, including the spinebills, are briefly dealt with below.

The genus *Melithreptus* includes seven species in Australia and Tasmania, and is also represented in New Guinea. It comprises greenish-yellow birds (often known as blackcaps) with black or dark grey heads and white underparts. Most of the species have a white stripe across the back of the head. The best-known is the White-naped Honey-eater (*M. lunu'atus*), a very common species throughout southern Australia. In northern and eastern Australia the White-throated Honey-eater (*M. albogularis*) takes its place; its Tasmanian representative is the Strong-billed Honey-eater (*M. val'idirostris*). The genus *Myzomela* includes the smallest honey-eaters, with long curved slender bills. A number of species occur in New Guinea, Malaysia, and the Pacific islands, five being found in Australia,



Drawn by N. W. Cayley and F. S. Rodriguez.

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1. Crested Tern (*Thalasseus bergii*).
2. Sooty Tern (*Sterna fuscata*).
3. White Tern (*Gygis candida*).
4. White Cockatoo (*Cacatua galerita*).
5. Black-backed Magpie (*Gymnorhina tibicen*).
6. Black-tailed Native Hen (*Tribonyx ventralis*).
7. Noisy Miner (*Myzantha garrula*).
8. White-browed Babbler (*Pomatostomus superciliosus*).
9. Sacred Kingfisher (*Halcyon sanctus*).
10. Yellow-winged Honey-eater (*Meliornis novaehollandiae*).
11. Yellow-breasted Robin (*Eopsaltria australis*).
12. White-eye (*Zosterops lateralis*).
13. White-breasted White-eye (*Zosterops albigularis*).
14. Grass Warbler (*Cisticola exilis*).

though only two extend into the southern portions of the continent. These are the Black Honey-eater (*M. nigra*) and the Sanguineous

White-naped Honey-eater (*Melithreptus lunulatus*).

Honey-eater or Bloodbird (*M. sanguineolenta*). The male of this species has the head and body

White-throated Honey-eater (*M. albogularis*).

bright scarlet, the wings and tail being black. It has a very pretty song.

The two species of *Acanthorhynchus*, a genus confined to southern Australia, are known as 'spinebills' on account of their long, slender, curved bills. *A. tenuirostris* occurs in south-eastern Australia and Tasmania, and *A. superciliosus* in the south-west. Both species have a crescent-shaped white band on the breast, surrounding a chestnut patch on the throat, which is especially distinct in the western species. *Glyciphila* is represented by four species in Australia, and extends to Timor, New Guinea and New Caledonia. The best-known Australian form is the Tawny-crowned Honey-eater (*G. melanops*), which frequents open, heathy situations throughout southern Australia and Tas-

Spinebill (*Acanthorhynchus tenuirostris*).

mania. The handsome Regent Honey-eater (*Zanthomiza phrygia*), the sole member of its genus, is peculiar to south-eastern Australia. It is black, with brilliant yellow patches in the wings and tail, many of the feathers on the back

Regent Honey-eater.

and shoulders also having golden edges. The cheeks are bare of feathers and covered with wart-like excrescences; hence it is often called warty-faced honey-eater. The little Brown Honey-eater (*Stigmatops indistincta*), the plainest in colour of all the Australian honey-eaters, is perhaps, the best songster of the family, its notes having a great resemblance to those of the reed warbler. It is common throughout the warmer

parts of Australia, though absent from the south-east corner.

Meliphaga (better known as *Ptilotis*) is by far the largest genus in the family, comprising some 40 species. These are found throughout the Papuan and Polynesian islands, and 23 occur in Australia and Tasmania. They are mainly dull green above and dull yellow below, usually with a tuft of stiff white or yellow feathers on the cheeks, and often with some black on the head and brown streaks below. Many of the species are very similar, and in the bush are only to be distinguished by experts. Some of the best-known are Lewin's Honey-eater (*M. lewini*), which commemorates the first writer to publish a book on Australian birds in Australia; the Singing Honey-eater (*M. sonora*), whose name is not very appropriate, as the loud, mellow notes which it utters hardly constitute a song; the Yellow-faced Honey-eater (*M. chrysops*), often called the 'chick-up' in imitation of its call; the Yellow-plumed Honey-eater (*M. ornata*), the White-eared Honey-eater (*M. leucotis*), the Wattle-cheeked Honey-eater (*M. cratitia*) and the White-plumed Honey-eater (*M. penicillata*), generally called 'greenie' in Victoria, and also known as 'chickoowee' from its note.

The genus *Meliornis* contains three species confined to southern Australia and Tasmania, all marked with black and white on the head and breast, and with a good deal of yellow in the wings. The most plentiful is the New Holland Honey-eater or Yellow Wings (*M. novae-hollandiae*), the White-cheeked Honey-eater (*M. nigra*) is very similar, but has more white on the head and is not so common. The third species (*M. pyrrhoptera*) derives its name of Crescent Honey-eater from the black band on its breast. It is also called 'egypt' in imitation of its notes.

W.B.A.

Honey-flower. See LAMBERTIA.

Honeysuckle. See BANKSIA.

Hookworm. See TROPICAL MEDICINE.

Hop-bushes. See DODONAEA.

Hopetoun, Earl. See LINLITHGOW, MARQUESS OF.

Hoppers. See HEMIPTERA.

Hops were first grown in Australia by James Squires, who in 1806 or 1807 produced a few pounds upon five acres of land near Ryde in New South Wales, and by 1812 had increased the yield to 1500 lb. For this he was presented by Macquarie with a cow. With the exception of a plantation made a little later near George-street-west in Sydney, and a few others of no great size, no further efforts were made, and hop-growing never made headway in the mother-colony. At one time it was expected that hop production would become an important industry in Victoria and in 1883 an area of 1758 acres was planted; but this dwindled to 307 acres in 1901-2 and 87 acres in 1917. In Tasmania, however, the industry flourished for many years, mainly along the Derwent River from New Norfolk upwards. From 1870 onwards the production fell not far short of a million lb. annually, but during the early eighties high prices stimulated planting to such an extent that over-production brought them down with a run and nearly ruined the industry. In 1900 the area under hops was 624 acres and the production 696,679 lb. Hop-growing in the Commonwealth is now practically confined to Tasmania and some of the cooler districts of Victoria. The total area planted for the season 1922-3 was 1741 acres, 1545 in Tasmania and 194 in Victoria. During 1922-3 imports exceeded exports by 727,276 lb., with a value of £51,497.

W. S. C.

Horn, WILLIAM AUSTIN (1841-1922), born in the Snowy River district of New South Wales on 24 February 1841, taken by his parents to South Australia in 1852, and educated at St. Peter's College, Adelaide, in 1861 took up pastoral life, and almost immediately found himself enriched by a partnership in the famous Moonta copper-mine; the ride to Adelaide from beyond Wallaroo—about 160 miles in 22 hours—by which he secured the mine is still remembered. He soon became well known in the mining world, and frequently visited England to procure capital for his ventures; during one of these visits, in 1872, he matriculated at Worcester College, Oxford, but did not complete his studies there, returning to Australia in 1874. In the early eighties he took a prominent part in opening up the Broken Hill silver-lead field. In 1887 he was sent to the South Australian legislature as member for Flinders, and held the seat until 1893. In the following year (1894) he fitted out an expedition to investigate the country between Oodnadatta and the Macdonnell ranges; the four volumes in which the results of this expedition are embodied contain a mass of geological, biological, botanical, and ethnological detail. In 1898 he left Australia and resided for the rest of his life in England, where he died on 22 December 1922. His benefactions to the city of Adelaide, which included some valuable statuary and an important collection of 11,000 ancient coins, were considerable.

Horne, RICHARD HENRY (1803-1884), was born in London on 1 January 1803 and educated at Sandhurst in order to enter the East India Company's service; failing to obtain entrance, however, he began an adventurous career by enlisting in the Mexican navy during that country's revolutionary war against Spain, and continued it with travels among the North American Indian tribes and a shipwreck in the Gulf of St. Lawrence. His return to England in a timber-carrying vessel gave him the added experiences of a mutiny and a fire aboard ship. From 1828 to 1852 he made new adventures in English literature, diversified by a friendship with Elizabeth Barrett Browning; among them was the publication of the epic *Orion* in ten books, the first three editions of which were issued at a farthing—eight more followed. In 1852 he came with William Howitt to Australia, and held various positions in the public service, beginning as commander of a gold-escort, and passing on to be successively a commissioner of crown lands, a territorial magistrate, and a member of the board of water supply which constructed the Yan Yean reservoir. In 1869 he returned to England, where in 1874 the Disraeli ministry granted him a civil list pension. After another period of miscellaneous authorship he died at Margate on 13 March 1884. While in Australia Horne wrote nothing of literary value. His reputation, however, and his strength of character made him a notable figure among Melbourne writers and critics of the sixties; probably the one debt Australia owes him is for his recognition in 1868 of Henry Kendall as her best poet. The name 'Hengist,'

by which he is often known he adopted in place of 'Henry' as a compliment to a Mr. Hengist whose acquaintance he made in the Victorian bush.

Horse Mackerel. See YELLOWTAIL and MACKERELS.

Horses. The First Fleet brought from the Cape of Good Hope one stallion, three mares, one colt and two fillies. The stallion and two mares were reckoned Government property; the others belonged to Phillip. In 1795 33 more were landed from the Cape, and by 1796 the records show 14 horses (including mares) as government property and 43 as belonging to the officers of the Corps; other settlers had none. Seven more mares arrived from the Cape in 1797, and another eight in 1800, and by that time the stock had increased to 203. King in 1802 reported that, 'being mostly of the Cape breed,' they were not very useful, and chiefly employed in carting and ploughing. In October of that year a fine stallion was sent from England to George Johnston (q.v.), and did ten years' useful service before dying. The next two years saw several such importations, nearly all from India. Robert Campbell brought in an Arab stallion in February 1803; King bought an English horse from Barrallier in August; in April 1804 a second Arab arrived, which King promptly bought and re-sold to the government; and in June six horses and a stallion were shipped from Calcutta, and it became possible to hope that the poor qualities of the Cape breed might gradually be neutralized. In 1805 the number of horses was 494, of which only 36 were government property and 72 belonged to officers of the Corps. But in 1806 the price of a horse was still high—'from £100 to £150' reported Johnson, 'for a common mare from 13½ hands to 15 hands high.' This evil soon cured itself. When Macquarie arrived in 1810 he found 1134 horses; when he left, there were 4564, and the price of a good cart-horse was no more than £10 or £15. There was even a small export trade to Batavia and the East Indies. Sir T. Brisbane imported a stallion whose fame was still great 50 years later: 'he was a beautiful bay' said John Lackey in 1873, 'and stood little more than 14 hands, with perfect symmetry combined with length, breadth, depth and muscle sufficient to furnish the mounted police corps with troop-horses that could scarcely be outweighted or over-ridden.'

A writer in 1826 thus summed up the then situation: 'There is, properly speaking, no breed of good draught-horses in the colony. The majority of the horses may be described of the nag kind, not very sightly in appearance, being narrow and sharp-backed, fall off much about the rump to the tail, low-necked and large headed. . . . they are, however, subject to few diseases and capable of enduring great fatigue, and will perform long journeys on indifferent keep much better than any horses in England. There is a breed of small Galloways, derived from crosses with the Acheen breed of ponies. They are very hardy and serviceable, and some of them handsome. Within the last few years some very good thoroughbred horses have been introduced from India and England. One of the best of these was Mr. Browne's Arabian horse *Model* from Calcutta; the best cross-bred horses now in the colony are derived from this very fine specimen of the Oriental breed. A cross-bred horse of his getting has been sold for 200 guineas for exportation to India. . . Some stallions and mares of the English and Flemish cart breeds have been lately introduced. . . . .'

In 1826 the Australian Agricultural Company (q.v.), soon after beginning operations at Gloucester and Stroud, imported some excellent types of Arab, Welsh, and English breeds. Their saddle-horses were famed far and wide, being admirable stock-horses for the rough and mountainous watershed of the Hunter; their power of endurance was almost incredible. At a sale of A.A. Company's stock at Maitland in 1840 37 mares (a few with foals) fetched from £35 to £95; 3 geldings, £34 to £51; 1 Clydesdale stallion, £175; 3 Welsh pony stallions an average of £53.

A brisk export of horses to India for military purposes grew up in early days, and in later years the Australian type (coming chiefly from New South Wales) was distinguished—and still is—as the 'Waler.' As pastoral settlement extended, however, and the need of horses to maintain it became greater, deterioration of breed set in. The services of thoroughbred sires became unattainable or expensive; colts, often of the most indifferent descriptions, were used in their stead, and ran loose with little mobs of mares and fillies about the settlers' homesteads. Such inferior stock in the early days of the Port Phillip settlement fetched £70, £80, and £100, and as a consequence the production of them was at once pushed to the utmost. The crisis of 1841-2 diminished the need, and abolished these fictitious values, and by the end of 1843 it was possible to buy three 'weeds' for the price of one saddle. From that time forward, while poor stock was much used (as it still is), high prices were given only for good qualities; and in 1873 Sir Hercules Robinson was able to tell a meeting of horse-breeders: —'I think it may be said of Australian horses generally that they are a great deal better than they look. . . . .Racehorses bred in New South Wales will compare very favourably with the best class of English thoroughbreds. . . . I think that the heavy draught cart-horses which I have seen are equal to anything I have seen in the world. What remains is just the great bulk of the light draught and saddle horses scattered over the country. They do not compare favourably in either appearance or condition with the same classes of horses in England, but then they are brought up in a totally different way. . . . . The only animals in which we are deficient are those which I may style fancy animals—horses which are produced under exceptional conditions, and at a very considerable cost, described as well-bred, fast-going, weight-carrying hunters . . . . An animal of that description would fetch £200 at home. We have not got it here, because there is no demand for it; if they are produced, they will not sell at a price that would pay . . . . '

W. H. L. Ranken says:— . . . . 'The ordinary horse of the country may be described as a light, hardy horse; he has a wonderful constitution, splendid feet, great endurance and very good temper. He is generally small, but there are many different types. The Arab, with short saddle-back, fine, broad forehead and grey colour, was not so rare a few years ago, but is becoming less common now than the higher, long-faced English horse, who sometimes is too heavy by strains of draught stock and sometimes very ragged behind by a cross with the Valparaiso horse. The last animal, with his weak

frame and bad quarters, did a great deal of harm to the breed of horses in the colony. His endurance and constitution the bush horse probably got with his Arab blood; but the climate of the country has done a great deal for him, as the horse, like the sheep, loves a dry climate. Of all bush horses the stock-horse is the best type. He is ridden all day, and turned out at night without brushing, cleaning, or clothing. He is shown the water, hobbled, and left to take care of himself for the night; at home he is put into a paddock as his saddle is taken off. In snow, or rain, or mosquitoes—in any season of any climate—he finds his only feed in the grass of the forest or plain. Next day he is brought up at sunrise, and ridden again. Day after day, for weeks of light work, or consecutive days of hard galloping after stock, he continues this life. He may have never been shod nor stabled, nor have tasted corn in his life. He will travel along the hot, dusty roads, doing his two (sometimes his three) hundred miles in a week. A hundred miles and more in twenty-four hours have often been accomplished by a bush horse upon grass food, without breaking his constitution or hurting his feet; for the climate supports his vigour, and there are no metal roads in the bush.'

There is a considerable difference in the style and make of horses bred in the several States, ranging from the light types of northern and tropical Australia to the heavier classes of the temperate climates. This difference is, no doubt, to a large extent the result of climate and surroundings. In Victoria really heavy draught-horses are raised; 'the smaller the holdings, the heavier the draught horse' seems to be a general rule. The draught-horses of New South Wales are on the whole distinctly smaller and lighter than those of Victoria, and Queensland draught-horses are lighter still. Some writers attribute this to the greater area of holdings in the northern States. Where greater distances, they say, must be travelled by the cart-horse or wagon-horse, more activity and less weight are essential.

Partly on account of the suitable climate, partly because pastoral work in these days needs more horses than does agricultural work, Queensland has for some years taken the lead of the other States in horse-breeding, and is responsible for nearly 31 per cent of the Commonwealth total. The war encouraged breeders, and 1917-8 proved the record years for number. It also temporarily increased exports, as the figures given below will show; but, while they are described in official statistics as 'exclusive of shipments for military purposes,' this only means that they do not include horses actually shipped for the use of Australian regiments—most of them went to India for use in the

Number of Horses in Commonwealth.

1860	431,525
1880	1,061,078
1900	1,609,654
1920	2,415,510
1922	2,390,460

Indian army. Apart from New South Wales and Queensland, which have for many years fought for the lead in production and held about 58 per cent of the Commonwealth total between them, the output of the several States has been singularly uniform; Victoria has had about 21 per cent, South Australia 11, Western Australia 7, Tasmania and the Northern Territory about 1½ per cent each.

The great decrease in exportation since the war is partly due to lack of care among breeders. Sir H. Chauvel (q.v.) reported in 1921 that less than 3 per cent of Australian horses were up to cavalry or artillery standard; in 1924 he stated that the breeding of light cavalry horses 'had reached a dangerously low ebb,' and recommended government assistance to the industry. In 1925 a Horse Association was founded in New South Wales for the express purpose of improving the breeds and establishing a higher standard.

Horses Exported from Commonwealth.

Year.	Total.	To India.
1906-10 (average per annum) ...	10,608	7,753
1911-13 ,, ,, ...	9,293	7,163
1914-18 ,, ,, ...	20,000	18,800
1919-22 ,, ,, ...	5,439	4,786

W.S.C.

Horton, WILLIAM (1800-1867), born at Louth in Lincolnshire in 1800, was in 1820 received into the Methodist ministry and in 1821 appointed to the Australian mission. He sailed in the *Brixton* with Samuel Leigh and William Walker as fellow-passengers; Leigh had visited England in the interests of a proposed mission to New Zealand, and Walker was appointed for work among the aborigines. Reaching Hobart in August 1821, Horton found that the small Methodist body lacked a minister, and determined to stay there. Sorell, who favoured all religious bodies, gave the Methodists a grant of land for a chapel, and leave to perform services in the government school-houses, but recommended Horton to give special attention to districts where the population was on the increase and could not be supplied with official chaplains—he instanced Macquarie Harbour, and offered to build a house for the missionary if Horton could provide one. Hobart, however, was as much as Horton could look after, and there he laid the foundation of the first Methodist chapel, though it was not opened until 1826. In October 1823 he was transferred to Sydney, and given charge of the Windsor district, moving to Sydney in 1826 and returning to England in February 1829. For the next 23 years he ministered at various stations in England and Scotland, retired from active work in 1852, and died in London on 18 June 1867.—His cousin Samuel Horton, who migrated to Tasmania in 1823, settled at Ross, and in 1852 founded the Methodist training institution known as Horton College.

Hospitals. In each State capital there is at least one large general hospital, and most country centres possess smaller ones. The chief cities also support hospitals designed especially for women, children, patients with infectious diseases, etc. Private hospitals are numerous, but cannot be dealt with here. The financial basis of most of the large general hospitals—which (except for a few institutions maintained wholly by government) are supported partly by endowment and voluntary con-

tributions and partly by government grants—has been at times so insecure as to hamper their work. Recently efforts have been made in some States to remedy this by legislation. In South Australia an act of 1920 empowers the inspector-general of hospitals to make levies on local government authorities for hospital support. In Victoria a central authority was constituted in 1922 to control the distribution of government subsidies, etc. The Western Australian government in 1921 appointed a commission to inquire into the subject. In New South Wales and Queensland no comprehensive scheme of hospital administration has been enforced by legislation, existing acts covering the activities of general hospitals merely providing for their incorporation, for the election of members of committees, etc.

Sydney Hospital.—Until 1848 the Sydney Hospital was financed and controlled by the British authorities dealing with transportation. The First Fleet carried a complete medical staff, from which a principal surgeon (John White, q.v.), three assistant surgeons (William Balmain, Thomas Arndell, and Dennis Considen) and a junior (John Irving) were appointed a medical staff for the colony. Early in February 1788 work was begun on a hospital building on the west side of Sydney Cove; but its accommodation was inadequate, and after the arrival of the second fleet it was found necessary to pitch between 90 and 100 tents in the grounds. Of comfort for the sick there was none. Under the direction of Governor Hunter and William Balmain (who had taken over White's duties in 1794) the first hospital was pulled down, and a new one erected on a stone foundation near the site of the present Argyle Cut; a store and dispensary were added. The principal surgeon was in charge, with one assistant surgeon and a staff of 20 convicts in Sydney, one surgeon at Norfolk Island and one at Parramatta. In 1805 Thomas Jamison succeeded Balmain as principal surgeon. On his arrival in 1810 Governor Macquarie declared the building of a new general hospital an absolute necessity. Seven acres of land were chosen 'on the elevated ridge of vacant land south of Government House' along which Macquarie-street was opened. In order to relieve the government of this additional burden Macquarie entered into a curious agreement with the contractors (Garnham Blaxcell and Alexander Riley), by which their compensation was to take the form of a monopoly for the importation of 45,000 gallons of spirits during the following three years; minor concessions were allowed, the monopoly was extended to the end of 1814, and the hospital, occupied in 1816, was completed in July of the following year.

D'Arcy Wentworth (who had been acting principal surgeon since 1809 in the absence of Thomas Jamison, and succeeded to the permanent position in 1811 on Jamison's death) became a party to the contract, with Macquarie's permission, after it was accepted. When the hospital was opened he naturally took charge of it, with William Redfern as assistant surgeon, but during his term of office (1816-19) chaos reigned in hospital administration; overcrowding was frequent, there was no one in charge of the wards between sundown and 6 a.m., and the patients were allowed to do their own cooking and washing in the wards. James Bowman, who took over control on 25 October 1819, prohibited these practices and secured some measure of order. Nurses and wardsmen were required to sleep on the premises, Bowman himself made a daily inspection of the patients, initiated the classification of diseases, and made investigations into the medicinal properties of Australian plants. In 1829, when Bowman was appointed inspector of colonial hospitals, James Mitchell (q.v.)—who had been mainly responsible for the work at Sydney hospital since 1825—was promoted surgeon in charge.

In 1836 the military and civil medical establishments, both in New South Wales and Tasmania, were combined on a military basis, a deputy-inspector-general of hospitals—John Vaughan Thompson—being appointed. Thompson was devoid of the tact necessary to conciliate civil and military interests, and issued ill-advised orders to the colonial surgeons. It was not long before he and Mitchell were at loggerheads over the management of the Sydney hospital, and in September 1837 Mitchell was dismissed the service. His successor at the hospital was more amenable to control, and harmony was completely restored when in 1844 Thompson was superseded by William Dawson. While under British control, the hospital was mainly used for sick convicts, but in the forties free paupers were admitted, a charge on their account being made against the colonial government.

On the cessation of transportation to the eastern mainland the British government being no longer obliged to maintain convict hospitals, gradually reduced the medical establishments in New South Wales. A hospital had been established at Windsor in or about 1812, a special building being erected in 1820; similar institutions were founded at Bathurst in 1824, at Liverpool in 1828 (Darling proposed to make this the principal hospital in the colony) and at Goulburn in 1834; all these (except that at Liverpool) were closed in 1842, and on 1 January 1843 the only medical establishments under government control were at Sydney, Parramatta, Liverpool, Newcastle, Port Macquarie and Moreton Bay. The two last mentioned were insignificant, their combined staffs numbering 13 only. The three country hospitals that had been closed were reopened as civilian institutions under private control, Goulburn and Bathurst at once (in 1842), and Windsor by the Hawkesbury benevolent society in 1846. The main hospital at Sydney was closed (as a government institution) in 1848, but had been dismembered many years earlier. At the end of 1828 Darling appropriated the north wing of the building for the use of the legislative council—it still forms the nucleus of the State parliament house; the south wing, after being used for some time as an ordnance store, was in 1843 transferred to the Sydney dispensary, an institution founded in 1826 for the care of the free pauper sick and maintained by public subscriptions until 1835, when it was subsidized from colonial funds. In 1848 the main building of the hospital was transferred from the British to the colonial government, which at once handed it over to the dispensary. The British medical officers were transferred to the medical staff in Tasmania, and 20 tons of hospital stores were sent to that colony.

As a civilian institution the hospital was managed by a board of directors which included members of parliament, the mayor of Sydney, and persons elected by annual subscribers and by donors of various sums from £20 upwards (including congregations which were represented by their ministers, legators represented by their executors, and societies, which could nominate their representatives). In all there were 31 members of the board, including two

secretaries and three vice-presidents. The administration by this heterogeneous body was very defective, and some improvements were made in 1865; in 1867 it was decided to appoint a superintendent with control of all employees and general oversight of all the details of management. In March 1868, therefore, there arrived in Sydney a trained nursing staff, consisting of a lady superintendent (Lucy Osburn) and five sisters who had been selected, at the request of Henry Parkes, by Florence Nightingale, for service in Sydney. The new staff had much opposition to contend with in its attempts to better the conditions of hospital reorganization and management; there was antagonism between the medical and nursing staffs, and confusion as to the authority of the manager and the lady superintendent. This difficulty was remedied in 1875 by the appointment of a paid secretary, who attended only to the external affairs of the hospital. The hospital became a training school for nurses, and the old illiterate women attendants were dispensed with.

The nursing system introduced by Lucy Osburn was the one aspect of hospital administration reported on favourably by the royal commission appointed on 8 April 1873 to inquire into the activities of the Sydney infirmary and orphan schools. Its report resulted in the Sydney Hospital act, passed on 15 November 1881, by which the institution was incorporated and its administration vested in a board of directors; at the same time its title was changed to Sydney Hospital. During the eighties physicians began to specialize, and various departments were opened, mainly for the treatment of out-patients.

A new building was opened in August 1894 at a cost (according to the official balance-sheet) of £93,601, of which sum £54,500 was provided by the government and £39,101 by subscription. On 20 October 1909 a clinical school for medical students of the university of Sydney was inaugurated. In 1924 the hospital had 362 beds and a resident medical staff of 29.

The Royal Prince Alfred Hospital, in Sydney, was founded to commemorate the gratification of the people of New South Wales at the recovery of the Duke of Edinburgh from the wound inflicted by an assassin at Clontarf in 1868. Long controversies about its site and its governing body delayed the erection of the building; but it was finally agreed that it should be placed on about 13 acres in the university area, that the hospital should be a general one for the treatment of patients without distinction, that the senate of the university should co-operate with the directors in electing the medical staff, and that the university should be allowed to establish a medical school in connection with the hospital. In 1873 an act incorporating the hospital was passed; in 1876 the foundation-stone was laid, but work was delayed until in 1878 the government gave further assistance. On 25 September 1882 the hospital was opened, providing accommodation for 146 patients. Most of the work up to this time had fallen on the shoulders of Sir Alfred Roberts who had studied hospital construction in Europe: he became honorary secretary of the hospital board and, with a brief interregnum between 1885 and 1887, practically ruled the hospital up to the time of his death in 1898. Following the arrival in 1883 of Thomas Peter Anderson Stuart (q.v.) arrangements were made for a course of hospital clinical study in connection with the university curriculum. On 27 August 1890 was laid the foundation-stone of a much-needed nurses' home, with accommodation for 50 nurses; the enlargement of the hospital and the consequent increase in the number of patients soon made this inadequate, and in 1911 additions to the nurses' home were built by the government providing accommodation in all for 216 persons. In 1902 work was commenced on two new pavilions intended as a state memorial to Queen Victoria; these were opened in 1904, modern equipment being gradually installed later, as the wards were opened for use.

In 1906 a department of medical gymnastics was opened for the treatment of physical deformities by Swedish drill and massage, the hospital thus becoming the first clinical school for massage students, who in 1918-19 numbered 92. Clinics have been established for the treatment of tuberculosis and venereal and dental diseases. During the war practically the whole resources of the hospital were placed at the disposal of the Commonwealth government for the treatment of returned wounded soldiers, many university graduates gaining valuable hospital experience here before taking up military duties. Two wards of 40 beds each are still set apart for military cases. From 1901 onwards until his death in 1920 Anderson Stuart was the ruling spirit of the hospital, and practically all the improvements in it were either devised by him or carried out under his personal supervision. In 1916 a social service department was established in connection with the hospital, which assists the families of poor patients and in other ways relieves the patients from worry and secures for them convalescent and other treatment when they leave the hospital. In 1923 was established the *Royal Prince Alfred Gazette*, the first hospital magazine in Australia.

The Royal Prince Alfred Hospital (the title 'Royal' was added by permission in 1903) is the largest endowed metropolitan hospital in Australia, having in 1924 520 beds and a resident medical staff of 29.

The Coast Hospital at Little Bay, New South Wales, is a general hospital with special provision for patients suffering from infectious diseases, including a leper lazaret with 16 patients in 1924; it was established in 1881 by the government as a result of the refusal of the directors of the Sydney Infirmary to admit a large number of patients suffering from measles during the epidemic of 1880. It is maintained by government, and is under the control of the director-general of public health; in 1924 there was accommodation for 694 patients and a resident staff of 11 medical officers.

St. Vincent's Hospital, Sydney.—On 31 December 1838 five sisters of charity (two of whom had studied hospital work in Europe) arrived in Sydney from Ireland, and for some years worked among the women at Parramatta; but in 1857 they were installed in a building in Victoria-street, Darlinghurst, which was later used as a school. The present hospital was opened in 1870 and enlarged in 1886. In 1857 it had 13 in-patients and 81 out-patients; in 1924 there were 225 beds, 3300 in-patients, 42,100 out-patients, and 30 medical officers in attendance.

The Melbourne Hospital.—In November 1839 the superintendent of the Port Phillip district purchased a building to be used as a temporary hospital and police office; but the space devoted

to hospital purposes was inadequate, and in March 1841 a meeting of influential citizens affirmed the desirability of establishing a central general hospital. While subscriptions were being collected with some difficulty, a cottage was rented in Little Collins-street; a larger building in Bourke-street was subsequently used to meet the needs of the sick poor. After prolonged negotiations with the Sydney authorities a site in Lonsdale-street was finally granted for hospital purposes, on 20 March 1846 the foundation-stone was laid, and early in 1848 the new building (with 22 beds) was ready for occupation. Part of this is still preserved, though the hospital was rebuilt in 1910-14 with the aid of munificent donations (including £145,000 from the Edward Wilson estate and £20,000 from the estate of T. J. Sumner) and a government grant. Large bequests from John Linay and Francis Ormond have also aided its growth. The hospital has a normal capacity of 358 beds but in 1923 the average daily number of inmates was 398. It is the principal clinical school for medical students of the university of Melbourne, and is also the largest training-school for nurses in the State. Attached to the hospital is the Walter and Eliza Hall Institute of Research in Pathology and Medicine.

The need of a second hospital for the Melbourne district was felt in the early sixties, and was publicly called attention to in 1865, but difficulties about the site delayed any active measures until 1868, when the escape of the Duke of Edinburgh from assassination was adopted (as in Sydney) as a reason for erecting a memorial of thanksgiving. It was decided that the memorial should take the shape of a hospital; work on the building was begun in November, on a site in Commercial-road given by the municipality of Prahran, and the foundation-stone was laid on 6 March 1869 by the Duke himself, the hospital being named the *Alfred Hospital*. It was opened on 4 May 1871, with 110 beds; additional wards were provided for by a bequest of £12,000 from John Linay, and were opened in 1885. In 1880 the first training-school for nurses in Victoria was opened in connection with the hospital, and in 1888 it was affiliated with the university of Melbourne as a clinical school for medical students. In 1910 it was incorporated. In 1921 work was begun on an extensive building scheme, and since then a nurses' home of 120 rooms, a surgical wing with accommodation for 80 beds, two operating theatres, a pathological block, enlargements to the electrical pavilion, and some administrative buildings have been erected. In addition to this the whole of the hospital has been practically remodelled since the beginning of 1921. It has now (1925) accommodation for 300 adult beds and 40 children's cots. There are 67 honorary medical officers in attendance, and a medical superintendent and 16 other resident medical officers.

The *Homoeopathic Hospital* at Melbourne originated from a meeting held in Melbourne on 30 October 1869, at which it was decided to establish a homoeopathic dispensary. This was opened in Collins-street, and the managing committee included the chief justice (W. F. Stawell) and the dean of Melbourne. In 1876 the dispensary was turned into a hospital and moved to Spring-street, and in 1882 the foundation-stone of the present building in St. Kilda-road was laid by Lord Normanby, then governor of the colony. The southern wing was built and equipped at the expense of James L. Hosie in 1890. A training-school for nurses is attached to the hospital. Provision will be made for 140 beds when the new building, now in course of construction, is completed.

The *Victorian Eye and Ear Hospital*, opened as a private institution in 1863 by Andrew S. Gray, was converted into a public hospital in 1868, and in 1870 amalgamated with an already existing 'Ophthalmic and Orthopaedic Institution' conducted by Dr. Aubrey Bowen. In 1881 it was moved to its present site on Eastern Hill. It has accommodation for 94 in-patients. Being the only hospital in Australia dealing exclusively with disorders and diseases of the eye, ear, nose, and throat, it is attended by patients from all the States of the Commonwealth. The *Women's Hospital* (209 beds) dates from 1856, when it was established near the eastern end of Collins-street; in 1858 it was moved to Carlton. *St. Vincent's Hospital*, with 120 beds, was founded in 1893, and in 1910 was recognized as a clinical school attached to the university. The *Austin Hospital for Incurables*, the only one of its kind in Victoria, was opened in 1882 with 52 beds; it can now accommodate 290 patients; all its beds are constantly occupied, and there is usually a waiting-list of 130 to 150 urgent cases.

The *Brisbane Hospital* dates from the earliest days of the settlement. Hospital accommodation was provided in Brisbane in 1825, and in 1828 a general hospital for sick convicts was established. When the penal settlement was broken up, the institution passed into local control under the title of 'The Moreton Bay General Hospital.' On 12 January 1849 was founded the Brisbane Hospital, which for 17 years stood on or near the present site of the supreme court; about 1866 it was moved to its present position in Herston-road. An adjacent hospital for infectious diseases is administered by the committee under contract with the metropolitan authorities. At Sandgate, 12 miles away, there is a convalescent home. The Brisbane hospital can now (1924) accommodate 360 patients, and has 9 medical officers in attendance.

The *Perth Hospital* was established as a colonial hospital on 14 December 1840 in St. George's-terrace, opposite the entrance to government house; in 1855 a new building, now used as an out-patients' department, was erected in Murray-street on a reserve of 7½ acres. In 1860 166 in-patients were treated. The administrative block was built in 1894; in 1897 the surgical wing (with an operating theatre) was erected, in 1904 the medical block, and in 1909 the nurses' quarters. In 1907 the government handed over to the control of the board the *Victoria Hospital* at Subiaco, about 3½ miles away; this has a quarantine reserve of 40 acres, and all infectious cases are treated there. The hospital also contains a mental ward, where patients suspected of mental disorders can be kept under observation before being committed to an asylum. In 1921 4201 cases were treated at the hospital. In 1925 the Perth hospital had 420 beds and 9 resident medical officers.

The *Public Hospital* at Hobart (often called the *Hobart General Hospital*) was originally an institution for the care of sick convicts. For some years houses ill-suited to the purpose were used; in December 1819 work was begun on a 'Colonial Hospital,' which was built on the site of the present general hospital in Liverpool-street. In 1835 the military and civil medical establishments were combined on a military basis. In view of the proposed transfer of Im-

perial establishments in the colony to the colonial government after the cessation of transportation, a joint committee of both houses of parliament was appointed on 23 September 1858; as a result of its findings the colonial secretary gave notice to the comptroller-general of convicts that the hospital would be taken over by the director of public works on 31 December 1859. A board of management was thereupon appointed by the governor-in-council to control the hospital; the board was dissolved in 1874 and a board of visitors substituted. A trained nursing staff was introduced from Sydney in 1875. As the result of a royal commission's report, issued in January 1877, an act was passed vesting the management of the hospital in a board with full statutory powers. In 1884 an isolation hospital was added; the first block of the present nurses' home was completed in 1893;an operating theatre was built in 1895; and a children's hospital attached to the general hospital was added in 1909. Two royal commissions appointed in 1914 and 1915 reported adversely on the state of the hospital buildings, and various improvements have been made since the close of 1917. During the latter year the honorary medical staff resigned owing to the premier's refusal to alter the practice of admitting patients without regard to social position. In 1918 was passed a hospitals act which *inter alia* constituted the hospital board a corporate body. In 1923-4 the hospital accommodation was 225 beds, with five medical officers in attendance.

The *Adelaide Hospital*, situated on North Terrace, is controlled under the hospital act of 1921 by a board of three members with the inspector-general of hospitals for the time being as chairman. Apart from, but worked in conjunction with, the general hospital is a block for the treatment of infectious diseases, to which cases are sent by direction of (and partly at the expense of) local boards of health. The hospital board also controls a consumptives' home on North Terrace, at which provision is made for cancer patients, and a dental hospital in Frome-road, which was opened to the general public in July 1923. The South Australian government laboratory of bacteriology and pathology is situated in the hospital premises.

Hotham, Sir Charles (1806-1855), born at Dennington in Suffolk on 14 January 1806, entered the navy on 6 November 1818 (lieutenant, 1825; commander, 1828; captain, 1833), and after service in many seas distinguished himself during some naval operations against Argentina in 1845. In 1852-3 he was entrusted by the foreign office with negotiations for commercial treaties with Paraguay and the Argentine, and his success was rewarded with the governorship of Victoria. Joseph Latrobe (q.v.), wearied with 15 years of rule in that restless settlement, and confronted on the one side with a constitution that fettered his hands and on the other with a mass of unruly gold-digging immigrants, in 1853 resigned the lieutenant-governorship; the British authorities replaced him with Hotham, who, having no wish for the appointment, insisted that he should be allowed to resign as soon as he obtained flag rank. He reached Melbourne on 22 June 1854 amid general rejoicings, in view of the new and more liberal constitution which he was expected to inaugurate in practice if not officially, and his first declarations of policy were such as his hearers desired. But once in the saddle he found it impossible to depend on popular methods of administration The colony's finances were in great disorder, and he had been directed before leaving England to insist on retrenchment and a sound policy for the future; he therefore almost from the first incurred the unpopularity inevitable by retrenching administrators, and his 'quarter-deck' manners merely augmented the ill-feeling against him. By October he found himself at loggerheads with a large body of diggers, of whom those on the Ballarat field were the most restive, and there followed a startling series of events which are narrated in detail elsewhere (see Eureka Stockade). Hotham was unused to the undisciplined life of goldfields, and not fully informed of the real grievances behind the revolt; but he kept his head, appointed a commission of prominent colonists to enquire into the whole affair, and intimated that he would accept such reforms as the commission should recommend. The actual leaders of the revolt, however, he regarded as rebels against the British crown, and insisted on their trial. Public feeling was so strong that no jury could be found to convict them, and the governor became more unpopular than ever.

Meanwhile the new constitution was on its way. On 2 May 1855 Victoria was given a 'governor-in-chief' of its own, and on 23 October of the same year Hotham received the text of the Imperial act, which he proclaimed on 23 November. Confronted with the transformation of an executive council which he controlled into one which was responsible not to himself but to the legislature, he laid down conditions which, although nowadays they seem harmless because a governor's authority is admittedly nominal, were in the eyes of men accustomed to governors possessing real authority fraught with serious danger. He demanded that his ministers should obtain his personal sanction before introducing any bill into parliament, and claimed a veto on all appointments to public office, announcing at the same time that he would 'not be a party to the appointment of a person whose sole recommendation may be the advocacy of certain political principles.' When these demands were made public there was a storm of indignation, and Hotham withdrew them with the statement that they were merely an outline of his private views. The long struggle to do his duty amid misunderstandings and misrepresentations that were as continuous as unjust had broken down his health; he sent in his resignation on 23 November 1855, but died on 31 December, long before it could reach England. To himself he probably seemed a failure; but he left his successors an orderly colony with sound finances and a much improved system of land administration. (K.C.B., 1846.)

Houtman, Frederik. See Australia, Discovery of.

Hovea, a genus of the family Leguminosae, consisting of shrubs with purple or blue flowers, endemic in Australia. The stamens are united in a sheath opening on the upper side; rarely the upper stamen is free. *H. longifolia*, a tall, ornamental shrub with a wide range, has showy clusters of flowers, occasionally elongating into short spikes. *H. longipes* has a dark-yellow wood, hard and close-grained. Its young pods are eaten by the Queensland aborigines. *H. acuta*, a large shrub, has a firm, close-grained yellow timber.

Hovell, William Hilton (1786-1875), born at Yarmouth in England on 26 April 1785, began to earn his living at sea in 1796 and 12

years later was master of a vessel trading with South America. In 1812 he decided to migrate to New South Wales, where his father-in-law Thomas Arndell had been an assistant surgeon from 1788 to 1796 and had, after the arrival of Bligh as governor, fallen on evil days. Hovell took with him £500 worth of merchandise and a recommendation from the colonial office vouching for him as a desirable settler; after several delays he reached Sydney in October 1813, and in 1814 joined Simeon Lord (q.v.) in his endeavour to establish the New Zealand Trading Company. For some years he was restless. He commanded Lord's trading-vessel the *Trial* (after which Trial Bay is named) on voyages along the coast and to New Zealand—where he came into collision with the Maoris at Kennedy's Bay—and the *Brothers* (another of Lord's vessels) on a voyage to Port Dalrymple which ended in her total loss off the Kent group. In a later venture off the South Australian coast he met on Kangaroo Island sealers who told him of a great lagoon, possibly the estuary of a big river, lying in the bight of Encounter Bay. In 1819 he left the sea and settled near Narellan in New South Wales on a grant of 700 acres which had been given him in 1816; but he could not endure the monotony of straightforward farming, and at once began to explore the neighbourhood as far afield as the Illawarra and Bateman's Bay. In 1823 he opened up the Burragorang Valley, and for this service was granted an additional 500 acres. It was probably this achievement that led Brisbane to couple him with Hamilton Hume (q.v.) in the journey of 1824 to Port Phillip which is described under EXPLORATION BY LAND, for which each of the explorers received another 1200 acres. On their return from Port Phillip press paragraphs soon made it evident that Hume was jealous of Hovell's participation in the exploit, and the *Australian* protested that 'Mr. Hovell lacks all the qualities befitting a bushranger.' The *Sydney Gazette*, however, lauded him as 'the Mungo Park or Belzoni of Australia.'

As a result of the mistake by which the terminal point of the 1824 journey had been identified with Western Port, Hovell was in 1826 attached to the party which Darling sent to establish a settlement at that place. This party was in charge of Captain Samuel Wright of the Buffs regiment, assisted by Captain F. A. Wetherall of H.M.S. *Fly*; Hovell was sent with them to continue his explorations. He investigated carefully the country lying between Cape Paterson and Kooweerup Swamp, and the area north-west of that swamp to Carrum Swamp (which he provisionally named after himself) and the cliffs near St. Kilda; from the last-named point he corrected the mistake of 1824, roughly identifying the district in which Hume and he had really terminated their journey. His report, though optimistic, was not sufficiently favourable to justify the continuance of the Western Port settlement, and early in 1828 it was abandoned. Hovell's reward for this service was 1280 acres, but on terms which he described as little better than an absolute purchase; and as the previous grant of 1200 acres had to be sold to defray the expenses of the 1824 expedition (and returned a surplus of £20 only), he found himself in 1829 with little more than his original Narellan grant of 700 acres to farm on. Until 1837 he applied repeatedly for a further grant, but Darling's opposition stood in his way; the colonial office, however, in 1833 suggested that remunerative employment might be given him, and Bourke in 1837 remitted a debt of long standing owed by him to the government.

In 1853 Hovell revisited Port Phillip, and was welcomed as the original discoverer of the district. This stirred up Hamilton Hume, whom Darling had always recognized as leader of the 1824 expedition, to reassert his claims and to declare that Hovell, not he, had made the mistake about Western Port. The details of this unhappy controversy are carefully analysed by Ernest Scott in the *Journal* of the Royal Australian Historical Society (vii, 289-307), and Hovell's journal of the journey is reprinted in the same volume. During his visit to Geelong Hovell identified the terminal point of the journey as Bird Rock on Corio Bay, almost opposite Point Henry. There was a recrudescence of the dispute in 1874, after Hume's death. Hovell died at Sydney on 9 November 1875. His widow bequeathed to the university of Sydney some property at Goulburn for the endowment of a lectureship in geology and physical geography. His journal, on which Bland's account of the famous journey was founded, is in the Mitchell Library at Sydney.

The publication of this journal and of accounts founded on it requires separate notice. On 10 February 1825, less than three weeks after the return of the explorers, the *Australian* and the *Sydney Gazette* published almost identical summaries of the journal (the *Gazette* omitted a few sentences). A copy of the *Australian* was sent by Hovell to Jules Lejeune, the artist of Duperrey's expedition (see EXPLORATION, FRENCH), and by him communicated in a French translation to the *Nouvelles Annales des Voyages* (vol. 28, pp. 417-21). In December 1825 Bland announced the forthcoming publication of a book founded on the journals of both explorers, but shortly afterwards fell ill; when towards the end of 1826 he had a good deal of the matter in print, the supply of paper suddenly gave out, and publication was deferred till 1831. In that year appeared the first edition of the *Journey of Discovery to Port Phillip*, which Bland wrote up almost entirely from Hovell's journal, Hume's being scanty and imperfect. A second edition was published in 1837.

Hovell was by no means the ignorant old 'sea-dog' of the usual stories, most of which emanated from Hume's friends and were intended to depict him as a cowardly Englishman without any bush-craft, a mere foil to the gallant and expert young bushman of Australian birth. This malicious picture of him is sufficiently contradicted by the fact that he formed close friendships with several of the scientific staff of the Duperrey expedition, who were members of the Institut de France.

Howard, CHARLES BERNARD (1810-1843), born in England in 1810 and educated for ministerial work in the Church of England, was in 1834 appointed 'colonial chaplain' of the then still inchoate colony of South Australia. Sailing in the *Buffalo* with Governor Hindmarsh, he reached the colony on 28 December 1836, and as soon as the site of Adelaide was determined established a temporary church in the new town under a large sail which he dragged from the shore seven miles on a small truck. His next church was a room in the Adelaide court-house, itself a temporary building; then the Society for the Propagation of the Gospel sent him out a wooden building, but he thought it too flimsy, and pledged his credit for £1000 wherewith to erect

a stone church on North Terrace, which is now Trinity church. His tolerant broadmindedness endeared him to colonists of all denominations, and John Wrathall Bull declares that 'his example did very much to produce the harmony which prevailed in the colony in his day . . . . especially exhibited in the pleasing actions of Christians of all denominations contributing to the building funds for the erection of places of worship under whatever name they might be called.' For his own denomination he procured the building of churches in East Adelaide, Port Adelaide, and the Sturt: but in 1843, when the colony was almost bankrupt and Howard himself in very poor health, he was served with a writ for the amount borrowed to build Trinity church, and the shock killed him. He died on 21 July 1843. In 1840 he published in Adelaide a *South Australian Church Hymn Book.*

Howe, GEORGE (1769-1821), born on St. Kitts in the West Indies in 1769—his father brought the first press to the island, and was for a time official printer there—in the early nineties went to England and obtained employment in London printing-houses, among them the office of *The Times.* The experience he gained there stood him in good stead when in 1800 he was transported to New South Wales—for what crime we do not know, but he had adopted the *alias* of 'George Happy'—and is reflected in the detailed orders he sent to England afterwards, e.g. for type which 'must be had from the founderies of either the late Messrs. Caslon or Mr. Figgins.'

Reaching Sydney in November 1800, Howe was according to his own account immediately employed as government printer. The official budget of the colony, however, shows that during 1801 there was no government printer; but early in 1802 Howe was given the post, and impressed King as 'ingenious.' Late in the year he issued the first book known to have been printed in Australia—the *New South Wales General Standing Orders*; and early in 1803 he obtained permission from King to collect materials for a weekly newspaper, the first issue of which was made on 5 March 1803 (see PRESS). This *Sydney Gazette and New South Wales Advertiser* was nominally Howe's private speculation, but he was allowed to use the government type and press. For some years he did all the work—bought the paper, set up the matter (which he 'invented and obtained without any auxiliary assistance'), worked the press, and delivered copies to subscribers. His matter was severely censored by the governor's secretary, and his office was a small ramshackle building attached to government house, with a loft for stores; when Johnston's soldiers were looking for Bligh, Lieutenant Laycock of the Corps 'nearly dislocated the principal joints in his body' while searching the loft. Up to June 1806 Howe was a convict maintained at government expense, but on the 4th of that month received a full pardon, which incidentally threw him on his own resources for a livelihood, and accounts for his description of his first seven years of press-work as 'goading penury.' He eked out an existence by various devices; at one time he issued a *New South Wales Pocket Almanack*, price five shillings sterling, at another he opened an evening school to teach several branches of mathematics, 'Writing (if necessary), and the Grammar of the English Tongue.' He had rivals, one of whom offered to teach 'the English language, agreeable to the modern pronunciation, and grammatically, if required.'

With Macquarie better times came. That governor, astonished to find that Howe received no allowance as government printer, procured for him a salary of £60 a year. In 1812 he married a rich widow, and combined journalism with store-keeping; he began to make money, in 1813 went shares with Mary Reiby (see REIBY, THOMAS) in a speculation in sandalwood, and in 1817 was one of the original subscribers to the Bank of New South Wales. He was never quite freed from governmental supervision, for in June 1817 he had to obtain Macquarie's permission before printing handbills for the officers of the 46th regiment—and did not get it. He died in Sydney on 11 May 1821.

Howe, MICHAEL (1787-1818), born at Pontefract in Yorkshire in 1787 and apprenticed in youth aboard a merchant-vessel sailing out of Hull, after two years' service ran away to join a man-of-war, and a little later deserted and took to highway robbery. In 1811 he was caught, convicted, and sentenced to transportation to Australia for seven years, and reached Hobart in the convict transport *Indefatigable* on 19 October 1812. He was assigned to John Ingle, a former superintendent of convicts whose character (according to Macquarie and Davey) was none too good, but who was in spite of that a prominent settler. Growing restive, Howe soon escaped to the bush and joined a gang of bushrangers which had been formed as far back as 1810 by John Whitehead, and at one time had as many as 28 members. In May 1814 Macquarie, pursuing his policy of giving every criminal a chance of amendment, offered all Tasmanian bushrangers an amnesty if they surrendered on or before 1 December: Howe is said to have come in with the rest, but was out again and in full career by August, taking the opportunity to raid a farm of Ingle's only 12 miles out of Hobart. The fate of Whitehead is uncertain. The story told in Bent's pamphlet (see below) is that he and Howe had agreed that, if either was killed in a fight with the police, the survivor should cut off the dead man's head to prevent the pursuers from getting the reward; that Whitehead was killed in such a fight about mid-May of 1815, and Howe did what he had promised; but that the head was afterwards found, and the body was gibbeted on Hunter's Island. In September 1815, however, William Stewart, master of the merchant-sloop *Fly*, reported to the colonial secretary at Sydney that several bushrangers—John Whitehead among them—had been taken off by a whaleboat to one of the islands in Bass Strait, and were raiding the seal fisheries there. As another Whitehead, James, had joined the gang early in 1815 confusion is inevitable.

By the end of 1815, at any rate, Howe was the acknowledged leader of the gang. Remembering his early training, he at once imposed on his companions an almost naval discipline: it is said, indeed, that he administered to all who joined him an oath of obedience taken on the Anglican prayer-book—but this is probably a misinterpretation of the scene witnessed by one of his captives, when, before sending to the governor a letter signed by 11 of the bushrangers, Howe swore them on a prayer-book to abide by its terms. In 1816 he was signing himself 'Lieutenant-governor of the Woods' and in 1817 'Governor of the Ranges,' and he corresponded with both Davey and Sorell as an equal. Towards the end of Davey's term began a steady process of hunting down the gangs, and an aboriginal girl who had been Howe's com-

panion ever since 1814, offended at some brutality of his, offered herself to the police as a guide to his haunts. Consequently on 28 April 1817 Howe sent to Sorell, Davey's successor, a letter offering to surrender; Sorell granted him a conditional pardon for all crimes except murder, and promised to obtain if possible the King's mercy even for murders, provided that Howe made a full confession and betrayed his companions. The confession was eagerly expected, because it was widely believed among the settlers that the bushrangers had friends in high places. Howe was examined frequently by magistrates, and his depositions are described as 'voluminous and tedious,' but nothing came of them. The only man definitely implicated by Howe—as far as is now known—was the chaplain Robert Knopwood (q.v.), and his innocence was afterwards proved incontestably. No other information of any value resulted, and, when in September Howe disappeared again, Macquarie revoked the pardon with the comment that 'if ever taken alive, he will be a very fit and proper object to make a Public and awful example of.' As soon as the escape was known, Sorell at once sent off Mary, the aboriginal girl, to Sydney lest Howe should revenge himself on her. In April 1818 a government launch was stolen by a gang of prisoners in order to pick up Howe and put him aboard an American vessel, but the plot miscarried. Thenceforward he was alone and in constant danger; he robbed a few stockmen's huts, but was once more thwarted; in September 1818 a party including the New South Wales blackfellow Musquito (q.v.) took from him his pistols (a sore loss) and a knapsack in which was found his 'Journal of Dreams,' a little book made of kangaroo skin with the writing in kangaroos' blood. Besides a record of his dreams, which were for the most part of capture or death, the book contained long lists of vegetable and flower seeds and fruit-trees; for his waking dreams were often of settling down somewhere —probably in another colony under another name —on a farm of his own. But his pursuers were hot on his trail. On 21 October they laid a trap for him, concealing a soldier named William Pugh and a convict servant in a hut which he was expected to visit: there was a desperate struggle, and Howe was at last killed with the butts of his opponents' guns.

In March 1819 a small octavo pamphlet—the first book published in Tasmania—was issued by Andrew Bent (q.v.) under the too optimistic title *Michael Howe, the Last and Worst of the Bushrangers of Van Diemen's Land.* The first edition, priced at five shillings, was sold out by June, and in July another was issued at half a crown. To-day but a single copy remains, and that is in the British Museum; but the original manuscript, or the copy of it made for submission to Sorell's censorship, was re-discovered in Tasmania in 1925. This pamphlet is the sole authority for the greater part of Howe's career, but the *Historical Records of Australia* (III. ii) contain many references to him which are not always consonant with Bent's story; in such cases this article follows the *Records.*

Howe, Robert (1795-1829), son of George Howe (q.v.) was born in London on 30 June 1795, and in 1802 was brought by his mother to join his father in New South Wales. From the first issue of the *Gazette* in 1803 he was brought into his father's business, and in 1821 succeeded him as government printer, Macquarie considering him 'sufficiently competent.' His ownership of the *Gazette* was more prosperous and more exciting than his father's: in 1822 he was stabbed dangerously by a drunkard who had brooded over a friend's supposed grievances, and in 1824 a new newspaper came into competition with him. The attempt to murder him is interesting because at the trial of the assailant it was argued that stabbing was not a legal crime within the colony; the point was referred to London, and was of course dismissed, but 'in consideration of the doubt existing in the Colony as to the nature of the Crime' the sentence was reduced from hanging to transportation. In 1823 Robert's printing difficulties were nearly as great as those of his father; several issues of the *Gazette* were printed on China paper, and the ink (which had to be manufactured in the office) faded and made the matter almost illegible. In 1825 China paper was used again, two sheets being pasted together to provide a sufficient thickness.

On 14 October 1824 appeared the first issue of the *Gazette's* first competitor—the *Australian,* edited by Dr. Wardell, an English barrister, and for some time financed by W. C. Wentworth; one of Howe's employees was induced to take over the printing of it. The immediate results were favourable to Howe. As Wardell was not subject to censorship, Howe claimed his freedom also, and Brisbane granted it, reporting to Bathurst later that the concession was of benefit to the public; but Howe further claimed that, as he no longer had a monopoly of the press, he could not insert government proclamations and advertisements for nothing—and Brisbane had to pay. Darling soon found the expense too great, and compromised by giving Howe £150 a year for inserting all government proclamations and orders in the *Gazette* free of charge and supplying 25 copies of each issue for official use. Wardell's competition might have been serious, had not his airs of superiority alienated a number of business men and his attacks on Darling brought Howe definite and persistent official support. From May to September 1825 Howe experimented with a *Weekly Commercial Express,* mainly devoted to advertisements and commercial notices, but his plant and staff were inadequate to the publication of two journals. In 1826 another competitor, Edward Smith Hall (q.v.), brought out the *Monitor* (first issue, 19 May); his competition seems to have been more severe, for within two months Howe was persuading Darling to deprive Hall of the services of two convict printers—Darling, whose opinion of Hall was the lowest, needed little persuasion. On 1 January 1827 the *Gazette* appeared as a daily paper. The removal of the censorship, though justified and beneficial, allowed journalism to become more personal and often virulently aggressive, and Howe in 1826-7 found himself involved in several libel actions; in April 1826 John Macarthur threatened to 'destroy' him, in January 1828 he was horsewhipped by William Redfern, and later in that year his attacks on Chief Justice Forbes earned a severe reprimand from the colonial office. Before, however, this reprimand could reach him, he was drowned off Fort Denison in Port Jackson on 29 January 1829.

The reprimand was not the only thing he missed. For several years (since October 1825) he had been petitioning governors and the colonial office for the title of 'King's printer.' Brisbane suggested delay, but promised support when he reached England; Darling transmitted a fresh petition in 1828, but would not recom-

mend it; however, the colonial office on 11 November 1828 decided to grant Howe the title—too late to do him any good, as he was dead at least five months before the news reached Sydney.—A younger brother, GEORGE TERRY HOWE, was in 1825 made by Arthur government printer of Tasmania, in partnership with James Ross. He was also editor of the *Tasmanian Gazette*, which was issued first at Launceston on 5 January 1825 and then after a long interval—Howe having meanwhile dissolved partnership with Ross—at Hobart on 3 March 1827. On 30 August, however, he sold the paper to J. C. Macdougal.

Howitt, ALFRED WILLIAM (1830-1908), was the best-known of a family of Quakers which has left its mark on Australia. His grandfather, Thomas Howitt, was a Derbyshire farmer, whose three younger sons all visited (and two of them settled in) Victoria. GODFREY HOWITT (1800-1873), the youngest, an M.D. of Edinburgh and an ardent botanist, migrated to Australia in 1839, taking with him his brother RICHARD HOWITT (1799-1869), a nephew, and two brothers-in-law—one of whom, Robert Bakewell, helped to found the well-known firm of Goldsbrough, Mort & Co. Richard bought a farm which is now the Melbourne suburb of Alphington, spent a good deal of his time in excursions into the Mornington bush, and in 1844 returned to England, where he published *Impressions of Australia Felix* (1845), much praised at the time for its vivid pictures of bush life. Godfrey settled down in Melbourne to practise his profession, established a fine garden at the corner of Collins and Spring streets, was one of the first three honorary physicians attached to the Melbourne hospital (1847), an original member of the council of the university (1853), and a founder of the Royal Society of Victoria (1854). His reputation as a botanist and entomologist extended beyond Australia, and when he died in 1873 he bequeathed to the university his entomological collections and £1000 for a scholarship in natural science. It was to Godfrey that WILLIAM HOWITT (1792-1879), father of A. W. Howitt, came out in 1852, bringing his two boys with him and leaving his wife—the celebrated Mary Howitt—and her daughters at Highgate during his absence. Twenty years of almost incessant authorship and journalism had driven him, when the news of the Australian gold-discoveries reached England, to seek relief in a new country and a more vigorous outdoor occupation. The party reached Melbourne on 13 September 1852, and a month later set out for the diggings near Beechworth; unsuccessful there, they turned prospectors and discovered the Nine-mile Creek (Yackandandah) field, which was immediately overrun with diggers; after a visit to Albury, they returned to Melbourne, tried their luck at Bendigo, revisited the Beechworth field, and made their way back to Melbourne via Bendigo, Ballarat, and Geelong. William Howitt had by this time forgotten his distaste for literature; after short visits to Sydney and Tasmania, he returned with his younger son, CHARLTON HOWITT (1838-1863), to England, published two important books on Australia—*Land, Labour, and Gold* (1855) and a *History of Discovery in Australia, Tasmania and New Zealand* (1865)—besides several minor books inspired by his visit, renewed his voluminous literary output, became a spiritualist, settled in 1870 at Rome (where he helped to introduce eucalypts for planting on the marshy Campagna), and died there on 3 March 1879. Charlton Howitt, who left Australia reluctantly, sailed again in 1860 for New Zealand, went prospecting in the Canterbury district, and was drowned in Lake Brunner in 1863 while opening up a track across the Southern Alps.

ALFRED WILLIAM HOWITT, the chief subject of this article, was born at Nottingham on 17 April 1830, educated at Heidelberg in Germany and University College, London, and brought by his father to Australia in 1852. After the goldfields adventures narrated above he settled down temporarily on his uncle's farm at Caulfield, but soon became a drover and made a reputation as a fearless and expert bushman. In 1859 he was employed to report on supposedly pastoral country in the Lake Eyre district, which he found drought-stricken; in 1860 he was exploring and prospecting in Gippsland; and on 18 June 1861 he was made leader of one of the expeditions sent out about that time in search of Burke and Wills (q.v.). Howitt's party met Brahe (a former member of the missing expedition) on the Loddon and, guided by him, made straight for the camp at Cooper's Creek where the explorers had last been heard of; there they found the only survivor, John King, and the bodies of the two dead leaders. These Howitt at first buried where they lay, but afterwards, making a second journey to the Creek, brought back for a public burial in Melbourne. (Further details of all these journeys of 1859-62 will be found under EXPLORATION BY LAND).

For these services Howitt was in 1863 appointed police magistrate and goldfields warden in Gippsland, holding the positions until 1889. During the second expedition of 1862 to Cooper's Creek he had begun to study carefully the aboriginal tribes he encountered, making friends especially with the Dieri of the Creek. When settled in Gippsland he continued his studies, and anticipated the later methods of Spencer and Gillen by being initiated into the local Kurnai tribe and partaking in their secret ceremonies. Towards the end of the sixties he met Lorimer Fison (q.v.) and in 1871 began to collaborate with him in his ethnological studies, the result of the partnership being the publication in 1880 of *Kamilaroi and Kurnai*, which was followed up by a number of papers on aboriginal matters either published in pamphlet form or contributed to the *Journal* of the Royal Anthropological Institute or the *Transactions* of the Royal Society of Victoria. In 1889 he left Gippsland on appointment as secretary of mines to the Victorian government; in 1896 he became a commissioner of audit; and in 1901 retired from the public service to devote himself entirely to scientific studies. Ethnology was his chief preoccupation, and *The Native Tribes of South-east Australia* (1904) his most important book, but a paper on the eucalypts of Gippsland published in 1889, and reports on the geology of Gippsland contributed to a geological survey of Victoria in 1874-7, show his active interest in other branches of science. During a visit to England in 1904 he received an honorary doctorate of science from the university of Cambridge. He was also a fellow of the Geological Society and the Royal Anthropological Institute of Great Britain, and of the Linnean Society of New South Wales, and a medallist of several Australian learned institutions. He died at Metung in Gippsland on 7 March 1908, bequeathing his minerals to the university of Melbourne, his library to Queen's

College within that university, and his botanical collections to the national herbarium. With Fison he is described by Sir Everard im Thurn as 'pioneers of the new anthropology, who by their researches into the organization of the human family have given the study the character of an exact science.' (C.M.G., 1906.)

Hughes, Sir Walter Watson (1803-1887), born at Pittenweem in Fife on 22 August 1803, was educated at Crail, apprenticed to a cooper, and then took to the sea. In 1829 he found himself in Calcutta, and there purchased a vessel, *The Hero,* in which he traded between Calcutta and China for eight years. In 1842 he sailed her to Adelaide and settled there. After suffering many reverses, he acquired great wealth from the development (in 1860) of copper-mines at Wallaroo and Moonta on Yorke Peninsula; he had discovered the existence of copper there many years earlier, but had been too busy to exploit his discovery. In December 1872 he desired to give £20,000 to a college which had been founded to train students for the Nonconformist ministry, but Dr. Jefferis (q.v.) persuaded him to allot it to the establishment of a university at Adelaide. This munificent gift was followed by a similar one from Sir Thomas Elder, and the university was established in 1874. Soon afterwards Hughes returned to England, lived there quietly for many years, and died at Chertsey on 1 January 1887. (Kt. Bach., 1880.)

Hughes, William Morris, born in Wales on 25 September 1864 and educated at Llandudno grammar school and St. Stephen's school, Westminster (where he was a pupil-teacher and was inspected by Matthew Arnold) in 1884 migrated to Australia, landed at Brisbane, and was employed on work of various kinds—stone-breaking, carpentry, etc.—on the railway then being constructed from Mitchell to Charleville. During the next few years he did what jobs came to hand—boundary-riding, sinking post-holes, shed-building, work aboard coasting vessels (in one of which he saw the Gulf of Carpentaria), travelling stock from Peak Downs in Queensland to New South Wales. Then, tiring of out-back life, he came to Sydney, worked as a 'super' in Rignold's Shakespearian productions, and opened a small shop in Balmain in which he sold books and repaired locks and umbrellas. During the maritime troubles of 1890 he kept aloof from the strike, but, when the defeated strikers had dissolved into an unorganized rabble, created a union for them and was for many years its secretary.

In 1894 this union, which was all-powerful in the Lang division of Sydney, returned him as its representative to the legislative assembly. He entered Parliament at a critical moment in the history of Labour, during the discussions on the pledge of 'solidarity' which drove from the party several of its most prominent members (see Labour Parties), so that Hughes found himself in a position favourable to the recognition of his exceptional brilliance. At the same time he was active in building up the organizations of other trades, especially the shop assistants and trolly- and dray-men, and the passing of the early closing act of 1900 was due mainly to his untiring advocacy. Outside his colony he had for the time few interests. Like his fellow Labour members, he was willing to support a federation with a single legislative chamber, an elective ministry, and the initiative and referendum, but was indifferent to any less democratic form; the rejection of the referendum as a piece of political mechanism by the convention of 1897-8 made him and the rest opponents of the bill, but the party's platform for the 1898 elections did not even mention federation, although the bill was in reality the main issue of the campaign.

When federation was accomplished, Hughes, returned by an enlargement of his old waterside constituency, was one of the six New South Wales representatives of Labour in the Commonwealth parliament, and at once became chief adviser of the party's federal leader, J. C. Watson (q.v.). In Watson's ministry of 1904 he was minister for external affairs: he had, like other ambitious Labour leaders, studied for the bar and had been admitted in 1903, but wisely refrained from claiming the attorney-generalship until he had gained more experience. When Watson left politics, Hughes had claims to succeed him; but his brilliancy was against him, and Andrew Fisher took the vacant place, Hughes remaining chief adviser, and being responsible for most of the decisions of the federal party during its support of Deakin. He was chairman of the royal commission on the iron bonus in 1904, and of the navigation commission (whose labours resulted in the Commonwealth navigation act) of 1904-5, and in 1907 went to London to explain the provisions of the measure at a conference with shipowners and representatives of the British government. In 1908-9 he was attorney-general in the first Fisher ministry; and when in 1910 the Labour party came back to the federal parliament with a strong working majority, he was given the attorney-generalship in the second Fisher ministry, also taking special charge of the measures, military and naval, designed to organize and strengthen Australian defence, in which he had taken particular interest since his first entry into federal politics. While temporarily out of office in 1913-4 he was offered by his opponents the chairmanship of the newly established inter-State commission, but preferred to continue a political career. In September 1914 he returned to office as attorney-general in the third Fisher ministry, and became prime minister when Fisher in October 1915 took the high-commissionership. Throughout the war and until February 1923 he was prime minister, first of a purely Labour ministry (October 1915 to November 1916), then of a truncated Labour ministry—the anti-conscriptionist members of the first having resigned—(November 1916 to February 1917), then of a 'national war ministry' in which six members represented the 'liberal' party (February 1917 to January 1918), finally of a much enlarged and often reconstructed 'national' ministry, which in five years had four different treasurers, four ministers for customs, and nine honorary ministers (January 1918 to February 1923). Through all these changes Hughes remained the real as well as the nominal head, maintaining and expanding his prestige by two visits to England (in 1916 and 1918-9) during which he took a prominent part in meetings of the imperial cabinet and in the negotiations and conference that produced the treaty of Versailles. In February 1923 he resigned the prime-ministership, retaining his seat in parliament (in 1907 he had left West Sydney for Bendigo, and in 1923 left Bendigo for North Sydney), and has since taken a comparatively small part in Australian politics. In 1924 he undertook a comprehensive lecturing tour throughout the United States. (P.C., 1916.)

Hugo, JONATHAN BURKE, son of a Dublin tobacconist, arrived at Launceston in Tasmania about the end of 1811 in the 100-ton brig *Active,* which he had obtained with its cargo on credit from Alexander & Co. of Calcutta. At this time he called himself McHugo. While he was at Launceston, Major Gordon (the commandant at Port Dalrymple) was, to quote Macquarie's official despatch, 'So far Imposed on by the wild and extravagant Nonsense of Mr McHugo as to Imagine him to be one of the Royal Family Incog. and possessed of Authority at pleasure to supersede All Governors Commanders, etca. etca., wherever he pleased to Visit. In this Belief, Lieut. Col. Gordon had Actually Surrendered his Command to Mr McHugo, who was likely to have made a Very Alarming Use of the Power so Yielded to him, had not the Other Officers found it Necessary, to their personal Safety and the Duty they owed their Sovereign, to remonstrate with Col. Gordon, whereby they at length Effected the Measure of sending Mr McHugo hither under a Military Guard.'

In Sydney Hugo was examined by a medical board which pronounced him to be 'in a state of outrageous insanity;' in April 1812 he was sent back to Calcutta, was confined for 2½ years in a lunatic asylum, and eventually reached London, where in 1817 he was bombarding the colonial office with petitions. He claimed to be descended from Earl Bothwell and Mary Queen of Scots, and to be the rightful heir to the crown of England, but declared he would be content with 'a Moderate Subsistence.' Whether he obtained one, or what happened to him after 24 July 1817, has never been discovered.

T. D.

Hume, ALEXANDER HAMILTON (1797-1873), born at Parramatta on 18 June 1797, was the eldest son of Andrew Hume, who was in 1789 a superintendent of convicts at Woolwich, and for his knowledge of farming was selected with eight others to act as superintendent and agricultural instructor of convicts in New South Wales. He left England in the *Guardian* in September 1789, but owing to her breakdown at the Cape of Good Hope was transferred to the *Lady Juliana* and reached Port Jackson on 3 June 1790. In July Phillip sent him to Norfolk Island, apparently because he had some experience in growing and treating flax, and it was desired to utilize the New Zealand flax which grew in abundance on the island. Ross, then commandant, gave him his choice of convict labourers and settled him at the Cascades. The enterprise, however, was not a success, and towards the end of 1792 Hume was brought back to Sydney and made superintendent of convicts at Toongabbie, with charge of the government live stock there. King dismissed him from this post in 1800, Johnston reinstated him in 1808, and Foveaux again dismissed him in September; in November 1812 Macquarie granted him 100 acres near Appin, and he settled there.

The boy Hamilton was educated by his mother, and spent much of his time in bush adventures. In August 1814 he set off with his brother John to explore the bush southwards, and discovered the Berrima district, to which in 1815 he piloted Oxley's flocks. In 1816 he pushed on to Sutton Forest, and in 1817 accompanied James Meehan (q.v.) on the journey in which the Goulburn Plains and Lake Bathurst were discovered. For these explorations Macquarie gave him a land-order for 300 acres—but it was many years before he acquired the land. Between 1818 and 1822 he was a member of several exploring parties; in 1821 he discovered Yass Plains, and in 1822 with Alexander Berry worked up the Clyde on to the tableland near Braidwood.

When Brisbane in 1824 decided to encourage an expedition across country from Lake George towards Spencer Gulf, Berry recommended Hume as its leader. Brisbane joined with him William Hovell (q.v.); the story of the expedition is told under EXPLORATION BY LAND. For this work Brisbane granted him 1200 acres on the Crookhaven River, which in 1837 he passed on to Berry. In 1828 he accompanied (and was of great use to) Sturt on the journey during which the Darling was discovered; but the adventurous life had impaired his health, and he abandoned exploration to settle at Yass Plains, where Darling granted him 1280 acres. In 1855 Hume entered into a public controversy with Hovell about the expedition, the points at issue being (*a*) who led the expedition, (*b*) whether Hume as well as Hovell mistook Corio Bay for Western Port. With regard to the first point, though the exploration was certainly conducted in partnership, by 1827 the colonial office and Governor Darling recognized Hume as the leader. The second point is settled by Hume's own letter of 24 January 1825, in which he assured Brisbane that they had reached Western Port—a statement which he repeated to Earl Bathurst in April 1826. The controversy, however, let loose a flood of charges against Hovell—made partly by Hume himself, partly by three of his friends who as assigned servants had accompanied the expedition—which have since been accepted as facts without any further enquiry, and included in nearly all recent accounts of the journey. Nothing in the journals of the two explorers, or in any documents of the '20s or '30s, corroborates them; indeed, the mutual hostility of the leaders which they imply (and some explicitly assert) cannot be reconciled with the first-hand evidence of the journals. Against that no amount of railing accusation made 30 years afterwards by a sick man (who, by his own admission, had a very bad memory) can possibly prevail. At the same time the existence, as far back as 1825, of a certain jealousy between the explorers is shown by an anonymous advertisement in the *Australian* of 11 April 1825, which claims the whole credit of the discoveries for Hume and attacks Hovell as totally lacking in bushcraft.

In 1867 Hume published in London a *Life of Edward John Eyre.* He died at Yass on 19 April 1873.

Humus is the dark-coloured organic substance in the soil produced by the decay of vegetable matter. Moisture and a certain degree of warmth are necessary for its production. In sandy desert soils it may be altogether absent, while it forms the chief constituent of soils of the nature of peat. The process of decomposition is due in the main to micro-organisms. The nitrogenous material of the plant undergoes a process of nitrification, and the resulting humus becomes the principal storehouse of the nitrogen required (in the form of nitrates) for the next generation of plants. The cellulose is broken down, and converted into humic and ulmic acids, and finally into carbonic acid—all of which exercise a solvent action on the soil, and render the soil-constituents available for plant-food.

The presence of humus increases fertility in several ways. It has itself a strong affinity for water, which it retains, so that its presence minimizes aridity; it forms a mulch in the surface soil, thus preventing undue evaporation; as a non-conductor of heat, it helps to preserve an equable temperature; and it improves the texture of the soil, lightening stiff soils, binding sandy ones, and in all cases maintaining a friable condition and preventing impaction. Further, the production of vegetable acids and carbonic acid, and the formation of nitric acid referred to above, greatly increase the fertility of the soil, in the one case by dissolving out insoluble mineral soil-constituents, in the other by supplying nitrates, which are among the most valuable of fertilizers. Humus itself also contains a certain proportion of mineral fertilizing constituents, which are readily available as plant-food. It is noteworthy that the humus of soils in semi-arid regions contains a relatively larger proportion of nitrogen than the humus of moister districts; this, combined with the fact that these dry soils are richer in all kinds of plant-food than those in moister regions, accounts for the extraordinary increase of growth in such districts that follows good rains.

The presence of humus is, therefore, an essential condition of soil-fertility. Unfortunately it is the ingredient most subject, under dry conditions, to alteration and destruction. When humus loses its moisture, it is rapidly 'burnt out' by the combined action of sun and air; evaporation proceeds at a rapid rate, and results in the wilting of crops and herbage. The final result is the formation of 'scalded' spots (or even plains), and the subsequent removal of the fine surface soil by the wind. It is not uncommon in semi-arid districts for the soil to be heaped up by the wind against fences, so as to obliterate them completely. The showers of 'red rain,' occasionally reported, occur when rain falls through atmosphere loaded with this fine dust. The presence of alkali in the soil, or in the water used for irrigation, is also rapidly destructive of humus. Soils derived from limestone, or rich in lime—such as those derived from basalt and other basic rocks—are usually richer in humus than others, the lime combining with the humic and other vegetable acids to form more or less insoluble compounds.

Owing to the great importance of humus as a soil-ingredient, and the fact that it is the one most easily destroyed, the problem of maintaining the supply is among the most important with which the farmer is faced. Stubble and crop residues should be ploughed under in preference to being burnt off; this will do something to prevent the too rapid loss of vegetable matter. But it will generally be necessary to increase the supply of humus by other means. Among those most generally adopted are (1) the application of farmyard manure, or of compost manure, and (2) the ploughing under of a green crop. Except in cases where animals are stalled and bedded, farmyard manure consists wholly of animal excrement and contains very little vegetable matter; though excellent as manure, it is incapable of supplying the necessary humus. The compost-heap, or pit, is a very valuable adjunct to the farm, and should be found more frequently. The value of compost-heaps arises from the fermentation of vegetable and animal refuse in the presence of lime and soil, by which bush-scrapings, dead leaves, weeds, tops and stalks of vegetables, bones and animal refuse can be converted into a manurial substance rich in decaying organic matter and a cheap source of humus. Such a heap is made of alternate layers of refuse and of lime covered with earth. When more refuse has been collected, add another layer of it and then a layer of lime, covering the whole again with earth till the heap is three or four feet high. To keep the heap moist, all waste water from the farm and house (such as slops, urine, etc.) are added through a hole which is kept open at the top. In a few months it is ready for use. Pits may be made in the same way. While one heap or pit is fermenting, a second should be prepared.

Green-manuring—the ploughing under of a quickly-growing green 'catch-crop,' preferably a leguminous one—is the method of humus-supply most generally practised, and is specially suited for orchards, where a green crop can be grown between the rows and ploughed under without disturbing the trees. In other cases the catch-crop is grown when the land is lying idle between the harvesting of one main crop and the sowing of another. The nature of the catch-crop will depend upon the district, the time of year, etc.; but it should be one that produces abundant foliage. Leguminous crops are the most profitable; the foliage forms humus, and the roots are active agents in the formation of nitrates from the air within the soil, thus increasing the plant's supply of nitrogen. As an indication of the fertilizing value of green-manuring, it may be pointed out that, under favourable conditions, vetches yield about 10 tons of tops and three tons of roots per acre. The tops contain about 0.5 per cent nitrogen, the roots 0.2 per cent. By ploughing under such a crop the soil will gain about 1½ tons of dry vegetable matter (humus), and about 120 lb. of nitrogen—equivalent to six cwt. per acre of sulphate of ammonia, or nearly half a ton of dried blood.

F.B.G.

Hunter, JOHN (1737-1821), born at Leith in Scotland on 29 August 1737, was sent to the university of Aberdeen about 1753 to study theology with a view of entering the Presbyterian ministry. But the boy longed for a sea life, having already accompanied his father, a shipmaster, on a voyage to Norway which ended in shipwreck; and in 1754 he left the university suddenly and secured a position as captain's servant aboard H.M. sloop *Grampus*. This was the usual mode of entry into the navy for young men wishing to become officers; Lord Nelson himself began his career as captain's servant aboard H.M.S. *Triumph*. After 12 months as captain's servant young Hunter for 15 months learnt practical seamanship as an A.B., and was then rated midshipman in H.M.S. *Neptune* (master's mate, 1764; master, 1768; lieutenant, 1780; commander, 1782; captain, 1786; rear-admiral, 1807; vice-admiral, 1810). In the *Neptune* he took part in the expedition against Rochefort (1757) and the capture of Quebec (1759). At the end of the Seven Years' war he was appointed to the *Tweed* frigate, serving on the Newfoundland station, and for the next 13 years devoted himself to the close study of navigation, astronomy, and maritime surveying. In 1776 Lord Howe selected him to be master of his flagship the *Eagle*, and for his good work in the war of the American revolution insisted on having him promoted lieutenant, the examination for which rank he had passed in 1760. As lieutenant Hunter served in the *Berwick* at the Doggerbank action of 5 August 1781, but re-

joined Howe in the West Indies in 1782 as admiral's third lieutenant; almost immediately he was promoted to be first lieutenant of the *Victory*, and was then given command of the fireship *Spitfire* and (at the year's end) of the sloop *Marquis de Seignelay*.

In 1786 it was decided to found a settlement in New South Wales, and Howe—who since 1783 had been first lord of the admiralty—chose Hunter to be second captain of the *Sirius*. Phillip, who was first captain, was also governor of the new colony, so that Hunter was practically in command of the ship. Shortly before sailing he received a dormant commission as governor in the event of Phillip's death or absence from the colony. While on the Australian station he made valuable surveys of Port Jackson, Botany Bay, and Broken Bay, which are reproduced in the journal of his 1st lieutenant William Bradley, now in the Mitchell Library at Sydney. In 1790 the *Sirius*, after a stormy voyage to the Cape for stores (during which she circumnavigated the globe), was wrecked at Norfolk Island—a disaster for which Hunter was held not at all responsible by a court martial that tried him in 1792. In that year he had returned to England, and after his honourable acquittal busied himself with preparing for publication his *Historical Journal of the Transactions at Port Jackson and Norfolk Island*, which appeared in 1793. He then served in the *Queen Charlotte*, and was thus employed when Phillip resigned the governorship of New South Wales; he at once applied for and gained the appointment, and arrived in Sydney to take up his duties on 7 September 1795, at the age of 58.

The new governor soon realized the difficulties of his position. Since March 1792 the colony had been administered by Francis Grose, commander of the New South Wales Corps, who had substituted military for civil rule and vested the administration of justice in his officers. They promptly took advantage of the situation to further their private interests; their free grants of land were cultivated by convicts supported at government expense, their produce was sold at monopolistic prices to the government stores; they developed trading interests, buying whole cargoes as they were brought into port, and retailing them to the poorer settlers at prices so extravagant that the latter were brought to poverty and often to bankruptcy; they developed the trade in spirits to such an extent that 'rum' became an accepted currency. The effect on a population already deficient in civic qualities was such that Hunter wrote 'a more wicked abandon'd and irreligious set of people have never been brought together in any part of the world.' Hunter set himself immediately to re-establish the authority of the civil magistrates—a course which brought him into conflict with the military officers, already prejudiced against a naval governor; and thereafter under their leader Macarthur they repeatedly disturbed his administration and thwarted his attempts at reform. His efforts to have the Corps replaced by a force of marines had, owing to the exigencies of the war with France, no result.

Against the trading privileges of the officers Hunter could effect little. The poorer settlers solicited his support for a co-operative trading association, and in June 1797 he suggested to the colonial office the establishment of a public store, to be stocked from England with articles that could be sold at a price sufficient to cover costs—payment being taken in grain or stock, if necessary. The colonial office had already on 31 August 1797 despatched the *Barwell* with stores to be disposed of to needy settlers at prime cost; articles remaining in the government store after the requirements for public purposes and for new settlers were met were to be disposed of in like manner. Hunter added 25 per cent to the prime cost, in order to cover overhead expenses, and pointed out that the goods were still very cheap, as the officer-traders had previously charged from 100 to 1000 per cent, and sometimes more, on the cost of articles landed in Sydney. But supplies were forwarded from England somewhat irregularly, and the local opposition was strong, so that this system of public trading did not develop to any considerable extent under Hunter. Indeed in June 1798, no doubt under a misapprehension as to its objects, he went so far as to sanction a 'ring' which the trading officers and their friends organized to entrench their monopolistic position; 'every person' he wrote in a general order of 25 June, 'is desired to keep the possession of their own money until they are apprised by public notice that a cargo has been bought, the officers having undertaken the trouble of officiating as agents for the general benefit of the whole colony.' The delightfully naïve comment of the colonial office on this order was that it might be taken 'as a sanction to officers engaging in traffic'—as if they had not been doing that very thing for years past.

Nor was Hunter more successful in cutting down the expenses of the colony, which had increased considerably under the regime of the Corps. On arrival he found fewer than 20 convicts available for public works, though more than 1000 (of whom seven-tenths were males) were victualled by the government, the officers having taken into their private service as many as 13 convicts each to work their land-grants. On 31 August 1797 the colonial office instructed Hunter to allow only two convicts, maintained at government expense, to each officer. This instruction was nominally enforced from 1 August 1798 onwards, but was apparently evaded with success until King took office. Further, under Corps rule a good deal of public land had been allowed to lie idle, and Hunter did not feel himself able to recall from private to public service a sufficient number of convicts to carry on public works and cultivate public lands. Consequently, during the 22 months ending June 1798 a sum of over £29,000 was spent on grain and pork for government requirements; yet, as the colonial office pointed out, had the convicts victualled at public expense (except the two allowed to each officer) been employed in the cultivation of government land, no grain whatever need have been purchased during this period. Hunter was also confronted with the difficulty of arresting convict escapees who engaged in bushranging on the confines of the settlement, and with the Irish political prisoners, who continuously threatened trouble. The convicts as a whole were unruly, and Hunter had recourse to a system of night-watchmen to preserve order in the town. During this period, too, the colony was visited in 1798-9 by a severe drought and in 1800 by disastrous Hawkesbury floods.

Hunter's best services were rendered in the sphere of navigation, his encouragement of Bass and Flinders being particularly noteworthy. But he was unsuited to his office. The colonial office received direct from Macarthur and 'certain anonymous writers' letters animadverting on the governor's weak administration, and Hunter answered the charges on 25 July 1798 with a

bitter vehemence that must have prejudiced his case. The letter recalling him reached Sydney on 15 April 1800. On the same day Philip Gidley King returned to the settlement, bearing a commission (dated 1 May 1798) which authorized him to take over the government in the event of Hunter's death or absence. Hunter, however, refused to give up office until 28 September, on which date he embarked in H.M.S. *Buffalo* to return to England. Reaching it on 24 May 1801, he immediately demanded an enquiry into the charges made against his administration; none being granted, he proceeded to vindicate himself in several pamphlets, living meanwhile at first on a captain's half-pay and afterwards on a pension of £300 a year. He soon became one of the recognized authorities on the affairs of the new settlement, and his suggested reforms—which were eventually, if gradually, carried out—included a revision of the criminal code, improved law-courts, the establishment of an advisory council for the governor, the introduction of trial by jury and the development of a sound police system. In 1808, as we learn from a letter he wrote to the earl of Galloway, he was asked to go out again as governor, but was not anxious to do so, preferring if possible to serve on a commission to investigate the affairs of New South Wales. He was still deeply interested in the colony—'I have travel'd with a gun on my shoulder through all parts yet known in its interior', he told the earl—and anxious to have it maintained, both as a depot for supplying western South America with British manufactures, and to prevent the French and Spaniards from using it as a rendezvous in the Pacific. In 1809 he devised a lifeboat which for all practical purposes anticipated the modern designs. No further employement came to him, and he died in London on 31 March 1821.

As governor of New South Wales Hunter was not a success, but as a sailor he commanded the consistent respect of his contemporaries. Howe, who had been deceived by his modesty into thinking that he had no ambition, said afterwards 'Had I known that he had other wishes, I would have taken care earlier to have seen to his advancement.' He was, for a naval officer of those days, very well educated, and Falconer the poet and Burney the musician were his friends. To Australia his best gifts were his own accurate surveys and his judicious encouragement of zealous explorers, especially of Bass and Flinders.

See his own *Historical Journal*, his despatches in the *Historical Records of New South Wales* and *Historical Records of Australia*, and the account of his early life in the Naval Chronicle, vol. vi.

W.J.

Hunter, JOHN IRVINE (1898-1924), born at Bendigo in Victoria in 1898 and educated at the Albury district school, the Fort-street high school, and the university of Sydney (M.B. and Ch.M., 1920; M.D., 1924), was probably the most brilliant student that university has yet produced. During his undergraduate career he won practically every prize and scholarship open to him, including the John Harris scholarship for anatomy and physiology and prizes for pathology, operative surgery, clinical surgery, and a surgical essay. In 1919-20 he was demonstrator in anatomy; in January 1921 he became associate professor of anatomy—the youngest professor in any first-class university in the world. After a visit to Europe and America, to study the most recent methods in anatomical teaching and research, he was made in 1922 professor of anatomy at Sydney, succeeding J. T. Wilson (q.v.). Devoting himself especially to the study of the nervous system, he joined N. D. Royle of Sydney in an investigation of spastic paralysis which had remedial results of great value. Stated briefly, his chief discovery related to the functions of the sympathetic nerve system. A few years ago it was believed that this system supplied the involuntary muscles only; but Hunter and Royle discovered, first, that sympathetic nerves were present in voluntary muscles (i.e. muscles whose action can be controlled by the human will), and second, that their function was to stabilize the effect of voluntary muscle action. That is, if the impulse conveyed through a spinal nerve to a voluntary muscle places the arm in a certain position, the work of the corresponding sympathetic nerve is to make the arm keep that position until another impulse arrives. Consequently, if a spinal nerve is injured at any moment, the sympathetic nerve keeps the affected limb rigid in the position it was last impelled to take, and so causes what is called 'spastic paralysis.' Theoretically, therefore, the severance of the sympathetic nerve would release the limb—and Hunter proved experimentally that certain cases of paralysis could be thus cured completely. In June 1924 he and Royle were invited to explain their discovery at a clinical congress to be held in New York in October; and after demonstrating the success of the new methods to an assembly of 2500 surgeons from many parts of the world, and delivering lectures at several universities and medical schools, Hunter went on in November to England to lecture in Cambridge and London. He was, however, by this time worn out and ill, and at Cambridge succumbed to enteric fever, dying in London on 10 December 1924.

Brief as was Hunter's active career, he had already proved himself, in the opinion of Professor Elliot Smith (q.v.), the leading anatomist in the British Empire. In Sydney he was best known as a most lucid lecturer, a very capable organizer, and a lovable colleague; and on 23 December 1924 the senate of the university formally recorded its sorrow in a resolution from which the following passage is extracted:—'In his short life, so greatly lived, he won universal affection by his beauty of character. He rose through his genius, as it were ideally, to represent whatever is best in university training, to become equal with the great anatomist by whom he was taught and whom he succeeded, to inspire the medical school even from his undergraduate days, and to embody the hope of the future for the whole university.'

Hussar. See SNAPPER.

Hutt, JOHN, is first heard of as collector of the North Arcot district in Madras about 1830, and next as a member of Wakefield's National Colonization Society in 1832. When in 1837 it was decided by the South Australian colonization commissioners to recall Governor Hindmarsh, John Hutt was strongly recommended by his brother (one of the commissioners) and other notable men for the vacant post. The influence of G. Fife Angas having secured it for his candidate Colonel Gawler, the colonial office offered Hutt as a consolation prize the governorship of Western Australia, and on 28 April 1838 the two appointments were gazetted together. Hutt reached Fremantle on 2 January 1839, and, as became an associate of the Wakefield-Buller coterie, set himself to systematize the administration of the young colony without paying much attention to the wishes

of the colonists. He consequently incurred a good deal of unpopularity, though most of his decisions were based on sound sense; thus he would not allow immigrants to select land outside certain areas, because concentration of settlement was the only sure safeguard against aboriginal attacks. On the other hand he deliberately set aside instructions issued by the colonial office, early in 1839, to raise the upset price of crown lands to 12s. an acre; when in 1840 he was compelled to obey orders, the sale of crown lands almost stopped. His policy towards the aborigines was marked with friendly zeal, and by the end of 1841 had established harmonious relations with them and almost eradicated crimes of violence. The later years of Hutt's term were an epoch of great depression, mainly because the colonial office policy of enhancing the price of crown lands (in 1843 to 20s. per acre) discouraged immigrants—who could get better land in the eastern colonies for the same price—and reduced the revenue from crown land sales to about £8 per year. From the worst results of such depression the colony was saved by Hutt's caution and circumspection; but these are never popular virtues, and he welcomed the expiry of his term, returning to England early in 1846. He is next heard of as promoting in 1850 a Colonization Assurance Company, which sent more than 100 emigrants to Western Australia, but ceased operations when the colonial office refused to hand over to it the whole management of free migration to that colony.

John Hutt's brother SIR WILLIAM HUTT (1801-1882), who represented Hull in the imperial parliament from 1832 to 1841 and Gateshead from 1841 to 1874, was one of the most important men in the Wakefield circle. He joined the National Colonization Society in 1830 and the South Australian Association in 1834, was made a colonization commissioner in 1835, placed on the waste lands committee of the house of commons in 1836, and joined the New Zealand Association in 1837. In 1838 he and his friends made great efforts to have the land and immigration system of Western Australia assimilated to that of South Australia, but the colonial office persistently postponed its decision. In 1860 he was made paymaster-general and vice-president of the board of trade, and in 1865 negotiated a treaty of commerce with Austria. He died in 1882. The Hutt River, valley, and county in New Zealand are named after him. (P.C., 1860; K.C.B., 1865.)

Hutton, SIR EDWARD THOMAS HENRY (1848-1923), born at Torquay, England, on 6 December 1848 and educated at Eton, entered the army in 1867 (lieutenant, 1871; captain, 1879; brevet major, 1882; lieutenant-colonel, 1889; colonel, 1892; major-general, 1900; lieutenant-general, 1907), and served in the Zulu war (1879), the Boer war (1881), the expedition against Arabi (1882) and the Nile expedition (1884-5). In 1888-92 he commanded a corps of mounted infantry at Aldershot, and in 1893 was appointed to command the New South Wales military forces, with the local rank of major-general. In 1896 he was transferred to Ireland as assistant-adjutant-general, and in 1898 was sent to Canada to organize the Dominion's militia. In the early part of the South African war (1900-1) he had charge first of the mounted infantry under Lord Roberts and then of an independent column in the eastern Transvaal. In 1901 he was, by request of the federal government, sent to Australia to organize the new Commonwealth's military establishment, and it was mainly through his great administrative capabilities that the heterogeneous forces of six States were gradually shaped into a single army. This task completed, he returned to England at the end of 1904 and was given command of the 3rd division and the administrative charge of the Eastern Command. In 1907 he retired, but at the outbreak of the Great War volunteered again for service, and recruited and organized the 21st division of the 3rd (a Kitchener) army. He died at Torquay on 3 August 1923.

Hutton was from the first especially interested in mounted infantry. He raised and organized small forces of his own for the campaigns against the Boers and Arabi, commanded units in 1884-5 (the Sudan) and 1888-92 (Aldershot), and in the South African war led a mounted infantry brigade over 6000 strong, in which Australians and New Zealanders served side by side with British and Canadian troops. During his command in New South Wales he fostered mounted regiments, both light horse and mounted riflemen; he revived volunteering, particularly for 'national' regiments (the Scottish, Irish, English—St. George's—and Australian Rifles); and through his enthusiasm and military ability achieved for the New South Wales troops a much higher standard of training and military knowledge, particularly in the sphere of field operations, than had previously been attained in Australia. His term of service for the Commonwealth produced similar results throughout the Australian forces, and it was on foundations laid by him that all subsequent developments of Australian land defence were based. His interest in Australia was permanent, and he was from 1908 onwards a hearty advocate of the universal compulsory military training system. In 1916 he published *A Brief History of the King's Royal Rifle Corps, 1755 to 1915.* (K.C.M.G., 1900; K.C.B., 1912.)

Hybridization. See PLANT-BREEDING.

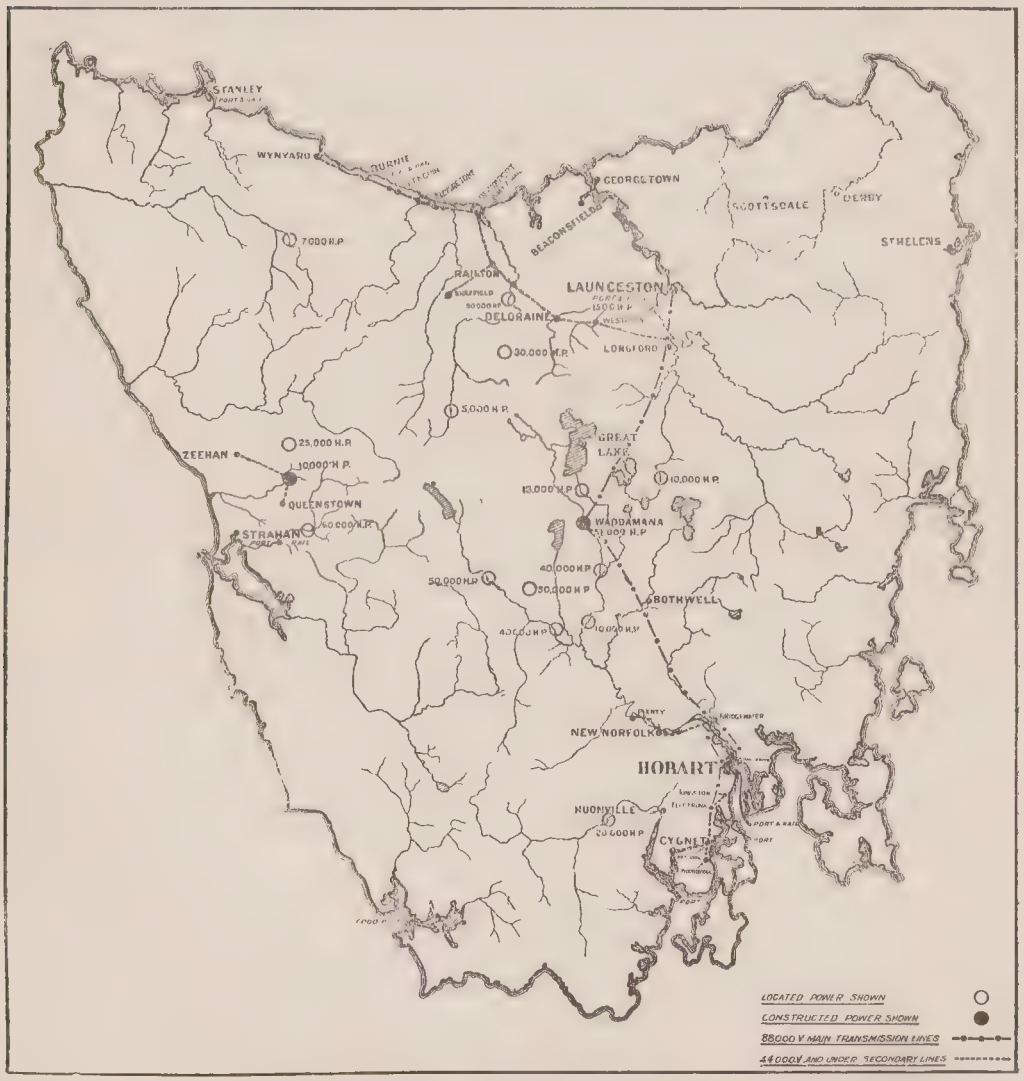
Hydrocharitaceae, a widespread family of aquatic herbs with five genera indigenous to Australia. The young flowers are enclosed in a membranous spathe. The genus *Vallisneria* has one indigenous species, *V. spiralis,* a submerged freshwater plant with a tuft of flat leaves, frequently grown in artificial aquaria. The male and female flowers are on distinct stems; the males numerous, in an oblong spathe, the females solitary, enclosed in a tubular-toothed spathe; petals obsolete. The male spathe is on a short stalk; the anthers when ripe burst the spathe, and the pollen floats to the surface. The female spathe is seated on a spirally coiled stem which unfolds gradually, carrying the flowers to the surface, where they are fertilized by the floating pollen. After fecundation the stalk contracts and draws the ovulary to the bottom, where the seeds mature. The genus *Ottelia* has 2 indigenous species. *O. ovalifolia* is a fluvial herb, with floating leaf-blades and lily-like flowers.

Hydrocotyle, a semi-aquatic genus of the family Umbelliferae, consisting of lowly herbs with minute flowers in small bractless clusters, dispersed over the warm and temperate regions of the earth. Of the 26 species indigenous to Australia 23 are endemic. The calyx-teeth are inconspicuous; petals oval, with a straight apex; fruit without oil receptacles, usually 3-ribbed

and smooth. *H. vulgaris*, a creeping mud-plant with orbicular leaves attached to the stalk by the centre (as in the garden nasturtium) and held horizontally, is the pennywort of Britain.

Hydro-electric Developments. In a continent where distances are great, coal-deposits rare (though rich within restricted areas) and water-power of the ordinary kind almost non-existent—since few rivers can be counted on to give a regular flow of any force worth using—the establishment of factories outside the limited coal-field area is a risky and expensive undertaking. Coal-miners in New South Wales have more than once almost throttled the manufacturing industries of other States, and those States have looked about for relief with more anxiety than skill. Yet in nearly all of them conditions for the successful installation of hydro-electric systems of power-manufacture have been present—the existence of natural or potential reservoirs in elevated areas not far from the chief towns, a plentiful rainfall over those areas, and a lack of serious obstacles to the transmission of the generated power. Little, however, was planned in this direction, and nothing at all was done, until the smallest of the States, Tasmania, showed the way so clearly that a migration of big industries thither seemed possible. Since then other States—even New South Wales, where the coal-fields mainly lie—have considered the establishment of such installations as Tasmania has now been enjoying since 1916. Victoria is for the present planning to derive manufacturing power from her brown-coal deposits at Morwell (q.v.), and has postponed hydro-electric generating stations, which would have to be made farther away from the manufacturing centre at Melbourne.

Tasmania.—In this State the central physical feature is a tableland from 2500 to 3500 feet high, fringed by a range (known as the Western Tiers) which catches the moisture brought along by the westerlies that prevail in the Southern Ocean south of 40° S. lat. As a consequence, while the average annual rainfall for Hobart and Launceston is about 28½ inches, that for



HYDRO-ELECTRIC SCHEMES IN TASMANIA.

the central tableland is from 100 to 120 inches, and is distributed with fair regularity throughout the year. Of the natural reservoirs on this tableland the Great Lake is the largest; but several of them possess the distinguishing feature of a river outlet which after a very few miles drops suddenly into a deep gorge, and the southern part of the tableland is intersected by these almost parallel gorges. In 1908 a private company secured a concession to utilize for the production of power the waters of the Great Lake, but by 1914 its capital was exhausted and it was compelled to suspend operations. At this juncture, the government decided to assume control of the uncompleted scheme, refunding the money already spent. The initial stage of the development, which was completed in 1916, consisted of a 10,000 horse-power installation for the supply of power to Hobart and to manufactories in its neighbourhood. The storage capacity of the Great Lake (which has an area of 50 square miles) was increased by the construction of a masonry dam 644 feet long and 12½ feet high, fitted with 10 sluice-gates. This gave a depth of 35 feet in the lake. The river-bed was used to convey the water for four miles; it was then diverted by a weir into a canal 3½ miles long, leading to a natural depression which has been used to form an intermediate storage reservoir. At the western end of this lagoon (which has a length of 1¼ miles and an area of 340 acres) there is a ferro-concrete penstock chamber, where the water, after passing through suitable screens, enters a woodstave pipe-line 4 feet in diameter and 5500 feet long. At the end of this line two steel pipes, 4300 feet long and 37 inches in diameter, convey it to turbines 1120 feet below. The water is discharged into a wheel pit and then, by way of a tail-race 600 feet long, into the river Ouse.

The power-house at Waddamana is a steel structure, covered with corrugated iron, erected upon concrete foundations. It contains the turbine-driven generating plant and switchgear; immediately outside it and in the open air are the step-up transformers and line switches. The first installation of plant in the building consisted of two turbines of the Pelton-wheel type with a normal rating of 4980 horse-power each while running at a speed of 375 revolutions per minute, coupled direct to 3-phase alternators generating current at a pressure of 6600 volts, with a frequency of 50 cycles per second. Two separate turbine-driven continuous-current generators for exciting the fields of the alternators are also housed in this building; each of these machines is capable of developing 160 horse-power when running at a speed of 150 revolutions per minute. Electrical power from the main alternators is stepped up by oil-insulated and water-cooled transformers to 88,000 volts, at which pressure it is transmitted 62½ miles to Hobart and 17 miles beyond that city to North-west Bay.

The transmission line consists of three 7-strand copper wires, each with a section of .05 square inch, supported by 5-unit suspension insulators from lattice-steel towers 60 feet high, spaced approximately 600 feet apart. Above the conductors a 7/10 S.W.G. galvanized steel ground wire is strung from the apex of each tower to the next. The overhead line from Hobart to North-west Bay is supported with wooden structures made from local timber. At the Hobart sub-station power required for use in the district is stepped down to 11,000 or 6600 volts, according to requirements. The pressure of the supply is further reduced at various sub-stations in the city for tramway, power, and lighting purposes.

By far the largest individual consumer is the Electrolytic Zinc Company of Australia, whose works are situated at Risdon, about three miles from Hobart; zinc is produced there at the rate of about 100 tons per day. Power is also being supplied to the Carbide and Electro-products Company—until recently the Hydro-Electric Power and Metallurgical Company (the private company which initiated the scheme)—for the manufacture of carbide of calcium and carbon electrodes; a sub-station of modern outdoor type has been erected at Electrona on North-west Bay, and about 5000 tons of carbide and 700 tons of electrodes are produced yearly. These works were in 1925 taken over by the government. At Claremont, north of Hobart, the Cadbury-Fry-Pascal chocolate factory is supplied with power.

So successful were the first attempts to supply power that the zinc works alone demanded three times as much as the installation was capable of supplying, and other districts of Tasmania asked why they should not share in the benefits of a national undertaking. Accordingly in 1919 it was decided to enlarge every part of the installation. A new dam, 1182 feet long and 40 feet high, of the multiple arch type, increased the area of the Great Lake to 60 square miles and its depth to 55 feet, and the available water was greatly increased by tapping the Ouse River five miles away and bringing its upper waters to the lake. Canals were widened, more turbines installed, the southern Tasmanian line duplicated, and a transmission line erected to convey current to Launceston. Here the principal consumers are two large woollen-mills. The total available power is now 66,000 horse-power, nearly all of which is sold. Another 15,000 is being developed, and further water-power to the extent of over 300,000 horse-power has been surveyed and designed, and will be constructed as soon as the demand arises.

Altogether Tasmania has seven plants for the distribution of hydro-electric power. The first was erected at Launceston in 1895 to light the town. In 1915 the Mount Lyell Mining Company established a station for its own use at Lake Margaret, where the rainfall is 140 inches a year; 9600 horse-power is available.

Other States.—In Victoria, as has been said, power is in the first place to be derived from the huge deposits of brown coal at Morwell in Gippsland; this scheme is described elsewhere. But hydro-electric schemes have also been considered, and in 1924 work was begun on a group of power-stations at the Sugarloaf in the valley of the Goulburn River, 53 miles north-east of Melbourne. It is further contemplated to derive power, when needed in the future, from stations on storage reservoirs in the Baw Baw ranges 30 miles north of Morwell, and on the Hume dam across the Murray above Albury. In New South Wales high-level lakes are lacking, and the great artificial lake at Burrinjuck (see IRRIGATION) is so far from any existing centres of manufacture that its power-developing capabilities are only just being utilized; though the necessary legislation was passed in 1919, it was only in 1924 that a beginning was made of an installation that will supply power and light to towns along the southern line of railway. Even farther from existing centres, but much more prolific of power, is a suggested installation near

Jindabyne on the Snowy River, where an output of 25,000 horse-power could be obtained without any regulation of the water-supply: the coast (at Twofold Bay) is only 90 miles away, and industries requiring large quantities of power at a low cost could easily be established there. The only important installation actually in use in New South Wales obtains its power from the Nymboida, a tributary of the Clarence River. To construct it the municipalities of Grafton and South Grafton, and several neighbouring shires, were in 1922 combined into a 'Clarence River County District,' which has dammed the Nymboida, tunnelled the range between that river and the Orara, and erected in the Orara valley a power-house that will supply when completed 16,000 horse-power to Grafton and the surrounding townships. Many farmers use current from this source both for lighting and for driving their machinery. A more extensive scheme (the Jackadgery) is being designed, involving other tributaries of the Clarence and eventually providing over 70,000 horse-power for lighting and factories. The Nymboida installation was put into operation in November 1924. The rest of the State is being thoroughly surveyed for hydro-electric purposes, 42 stations having been established on important streams to determine their normal flow and the amount of power obtainable from them.

A proposal to obtain power from the Hume dam near Albury has already been mentioned. Originally a Victorian suggestion, it has been provisionally adopted by the authority (representing the Commonwealth and the States through which the Murray flows) that is constructing the dam; it is further proposed that the Commonwealth and all the States should establish a central committee, with technical advisers, to supervise and standardize all future electrical power schemes in Australia.

In the other States, and in several districts of New South Wales, electrical power is obtained almost entirely from fuel-run power-stations; but schemes for obtaining power from the Barron Falls in northern Queensland, and from dams on the Fitzroy and Dawson farther south —also from the Glenelg River and its tributaries in north-western Australia, mainly for use in connection with the iron deposits at Yampi Sound (see IRON)—were under consideration in 1924. J.H.B.

Hydroid Zoophytes, the popular name of several genera of Hydrozoa, a class of Coelenterata comprising polyps and medusae with ectodermal gonads and no vertical partitions in the enteron. Most of the species are marine, though a few live in fresh water.

The simplest zoophyte is the freshwater polyp (*Hydra*), which is found attached to waterweeds in ponds. It is a delicate little animal, harmless to human beings, green or reddish-brown in colour according to the species; it averages one-third of an inch in length, and consists of a little column with a circle of thread-like tentacles at the summit. When a tentacle touches some small organism, the latter is paralysed, drawn into the mouth at the top of the column and thence into the simple stomach, and digested, the remains being cast out of the mouth. On the tentacles are numerous peculiar cells, each containing a little sac filled with a poisonous fluid as well as a barbed thread coiled up inside. A pointed process projecting from the outer surface of the cell acts as a trigger which, on being touched, causes the barbed thread to be shot out, thereby stinging and poisoning the prey. When once discharged, the stinging-cell cannot be used again, and is cast off and replaced by a new one. *Hydra* reproduces itself sexually by means of eggs, or asexually by forming buds which grow out from the wall, develop mouth and tentacles, and normally become detached. It may also be cut into pieces, when every fragment that contains a portion of both cell-layers will develop into a complete animal.

The sea-firs (*Sertularia, Aglaophenia, Halicornaria,* etc.), are horny, plant-like growths, which often occur in dense masses like miniature forests. In rock-pools they usually form merely fir-like growths on stones or shells; but the species that inhabit deeper water, and are sometimes cast up on our beaches after heavy weather, may attain a height of several feet and branch most luxuriantly. Although on account of their plant-like appearance they are often mistaken for seaweeds, these delicately branched sea-firs are in reality complex colonies composed of numerous little polyps, often so small as to be visible only under the microscope.

All the sea-firs have fundamentally the same structure as *Hydra.* The polyps are of two kinds, one set being in the form of an elongated sac with a crown of tentacles; the other, when mature, resembles a small medusa or jelly-fish. These are really special bodies carrying the generative organs; they originate as members of the fixed zoophyte, from which they are set free by breaking away as little umbrella-shaped bodies. These individuals differ widely from the fixed form, being indeed so unlike it that their origin would never have been guessed if the separation had not been seen to take place. The fertilized eggs of the medusa develop into the fixed hydroid colony. Free-swimming generative polyps or medusae occur only in some zoophytes; in many species the generative polyps remain in the colony and produce their eggs in that situation; some lose their jelly-fish structure to a greater or less extent, and may be reduced to a mere wart. When the generative polyps are free-swimming, the eggs are scattered over a wide area, and not crowded in the neighbourhood of the parent stock; further, the egg-carrying polyp can swim at the surface of the sea where food is plentiful. Sometimes the generative polyp shows a transition between feeding polyp and medusa; the umbrella can scarcely be said to exist, and the medusa, being unable to swim, can only creep about on its tentacles. Such a crawling medusa (*Cnidonema*) has recently been described from Port Jackson. *Tubularia* is a very graceful genus with large, delicate, pinkish, non-contractile polyps protruding from sheaths which cover only the stalks. It is common on buoys and the bottom of boats. *Pennaria* forms a branching colony, the stem of which is black, and the polyps intensely rose-coloured in life.

Australia has an exceedingly rich zoophyte fauna, the coast of New South Wales alone having yielded over 120 distinct species, while 20 species (belonging to 12 genera) have been recorded from Lord Howe Island. The principal zoological explorations and collections which have added to our knowledge of Australian zoophytes have been made by the *Challenger,* the *Thetis,* and the *Endeavour.* E.A.B.

Hymenoptera, a large order of insects including the ants, bees, wasps, saw-flies, ichneumon-flies, etc. Most of the Hymenoptera are beneficial to mankind, since the great majority

of them either prey upon injurious insects, or are parasites that infest and destroy them. Though many of the families have not yet been well studied, some 6200 Australian species have been already described.

Members of this order may be recognized by their peculiar membranous wings, the reduced hind-wing being connected with the fore-wing on each side by a series of small hooklets, so that the two wings act as one in flight. The venation is strikingly different from that of any other order, and a special terminology is used by most workers in it. At the base of the costa of the fore-wing there is a small hard plate, (tegula) attached to the thorax. The first segment of the abdomen is closely attached to the thorax, so that it appears to form part of that region rather than of the hind-body. It is called the propodeum, while the rest of the abdomen is distinguished as the gaster. The mouth-parts are always mandibulate, though a complex tongue may (as in bees) be developed in addition for the extraction of nectar from flowers. The larva is either caterpillar-like, as in saw-flies, or a legless maggot. It changes into a sub-pupa or praepupa, which is followed at the next ecdysis by a true *pupa libera* of very delicate structure.

Parasites are our friends or foes in so far as they tend to destroy man's insect foes or friends respectively. Few insect larvae are free from their attacks. They vary in size from the comparatively large species of *Pimpla, Ophion,* and *Mesostenus* (which attack the larvae of butterflies and moths, and of which only one individual matures from each host), or the curious long-tailed species of *Megalyra* (of which 30 or 40 may be reared from a single timber-boring insect), to the minute Proctotrypidae, of which one or more may be reared on the eggs of other insects. Other minute parasites are sometimes bred in hundreds from a single large larva, such as that of a hawk-moth. Scale-insects and aphides are destroyed by many small ichneumon, chalcid and proctotrypid wasps, and it is largely due to these and to the ladybird beetles (Coccinellidae) that such pests are kept within reasonable limits. Unfortunately many parasitic wasps also attack larvae of the ladybird and of other useful insects.

It is usual to divide the order into two sub-orders of very unequal extent. The sub-order Sessiliventres includes the saw-flies and their allies, in which the gaster is sessile, i.e. attached to the propodeum along a broad base; the larva is of the caterpillar type. Only two species of the Siricidae (horn-tails) are known from Australia; but the dominant family Tenthredinidae, the true saw-flies, is represented by more than 80 species, many of them large and handsome insects. The best known are species of the genus *Perga,* of which about 30 have been described; plate xix, fig. 29, shows *Perga dorsalis,* a handsome insect whose larva is a familiar object in the bush, hanging in masses upon the foliage of eucalyptus saplings, which they often strip entirely of their leaves. Before pupation these larvae travel quite a long way on the ground, and then enter the earth, and spin a huge mass of cocoons close together. Both larvae and cocoons emit a nauseating smell, suggestive of impure eucalyptus oil. Other interesting saw-flies belong to *Phylomastix* and *Pterygophorus. Pt. cinctus* is a beautiful fly, often found replete with honey on garden flowers, and having a larva with a long, sharply-pointed tail.

The Pear Slug (*Eriocampoides limacina*) often infests pear, cherry, and plum trees in Tasmania and the cooler parts of the mainland, and occasionally attacks hawthorn, apple, almond, and apricot trees. The black, slug-like larvae of this saw-fly, if allowed to work unchecked, may cause every leaf on a pear-tree to fall, so that the fruit hangs bare, and becomes sun-baked and worthless. The main damage to the cherry occurs after the fruit has ripened.

The large sub-order Petiolata includes all Hymenoptera in which the gaster is petiolate, i.e. attached to the propodeum by a distinct waist; the larva is a legless grub. It may be divided into four distinct groups:—
(1) Ichneumoniformia, containing all ichneumon-flies and parasitic wasps, except only the Proctotrypidae; the female abdomen ends in an ovipositor.
(2) Vespiformia, including all forms in which the female abdomen ends in a sting, and the pronotum extends back to the tegulae (proctotrypids, ants, flower-wasps, social and solitary wasps, etc.). The hairs of the thorax are simple, or at the most only twisted.
(3) Spheciformia, including wasps in which the pronotum does not extend back to the tegulae, and the trochanter is always one-jointed; the female always has a sting. The hairs of the thorax are similar to those of group (2).
(4) Anthophila, distinguished by the branched or plumose hairs of the thorax, and the form of the basal joint of the hind tarsi, which is thickened or flattened and often densely hairy; the female also has a sting. (See WASPS and BEES).

The numerous families of Ichneumoniformia may be arranged into three super-families, Ichneumonoidea, Cynipoidea, and Chalcidoidea. Amongst the Ichneumonoidea (ichneumon-flies) the best-known families are Megalyridae, Evaniidae, Ichneumonidae, and Braconidae. The first is peculiar to Australia; the other three are fairly well represented here, but the number of species is much greater in other parts of the earth. The Megalyridae (long-tailed wasps) are a small family of less than 20 species. Their larvae are parasitic in the larvae of wood-boring longicorn beetles. *M. fasciipennis* is our best-known species. Evaniidae are mostly black ichneumon-flies, with the gaster inserted high above the hind-coxae. *Evania appendigaster* is an extraordinary species in which the tiny abdomen looks like a mere appendage of the huge, stout thorax. In the Ichneumonidae (true ichneumon-flies) Australia has a number of fine species, of which one of the best-known is *Echthromorpha intricatoria.* Other fine ichneumon-flies frequently met with belong to the genera *Lissopimpla* and *Mesostenus.* The commonest of all are the dull red-bodied, slender ichneumons of the sub-family Ophioninae, very abundant in the bush, and frequently attracted to light; two well-known species are *Henicospilus turneri* and *Exochilum scaposum.* All these are beneficial insects, whose larvae parasitize lepidopterous caterpillars. Braconidae are smaller ichneumon-flies, possessing one cell less in the fore-wing as compared with the true ichneumon-flies. Many of them are prettily coloured. Thirty or more species are known in Australia; plate xix, fig. 30, shows the very charming *Cyanopterus rufus.*

Cynipoidea comprise the various families of gall-wasps, most of which cause galls in plant-tissues. Few species are known in Australia, most of our galls being formed by Homoptera.

Australia is rich in parasitic wasps (Chalcidoidea); some species are very fine, but most are small and inconspicuous. Girault has listed about 2000 species, most of them described by himself from Queensland. He arranges them in 14 families, more than 600 species belonging to the Eulophidae, 400 to the Encyrtidae, 150 to the Pteromalidae, while the Eurytomidae, Callimomidae, Chalcididae, and the two families of fairy-flies (Trichogrammatidae and Mymaridae) average about 100 species each; the other six families have only about 260 species between them. These insects parasitize the eggs and larvae of all kinds of insects, and most of them are on that account to be reckoned as beneficial. Some of the largest species have been bred from the cocoons of bull-dog ants and the larger wasps, while the minute fairy-flies can be bred from the eggs of dragonflies and other insects.

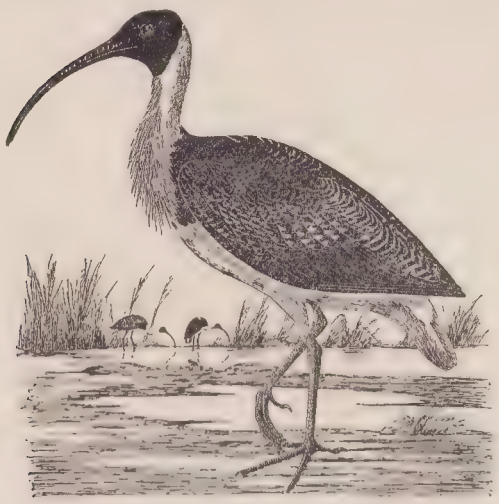
See Tillyard's *Insects of Australia and New Zealand.*

R.J.T.

I

Ibises, Spoonbills, and Storks, large long-legged birds with long necks and bills, constituting (with the herons) the order Ardeiformes; they frequent swamps, lakes and rivers (a few also inhabiting sea-coasts), feed on frogs, crayfish, fish, and insects, and construct nests of sticks, usually in trees, and often in large colonies where various species breed harmoniously together. Four families are represented in Australia: of these the herons are dealt with separately.

Of ibises (Ibididae) Australia possesses three species, the commonest of which is the Straw-necked Ibis (*Threskiornis spinicollis*), unknown outside Australia. This species is less aquatic than the others, visiting cultivated lands and pastures to feed on the grasshoppers that form its principal food. The average number of grasshoppers found in the stomachs of several birds investigated by D. Le Souef proved to be 2000; and he estimated that a flock he found breeding in the Riverina contained 240,000 birds. The great value of these birds for keeping down the grasshopper plague is therefore evident. The White Ibis (*Threskiornis molucca*), common throughout northern and eastern Australia, is nearly related to the Sacred Ibis of Egypt. The Glossy Ibis (*Plegadis falcinellus*) occurs throughout Australia and Tasmania, but is not a common bird; outside Australia it is almost cosmopolitan. A figure of some species of ibis —probably the straw-necked—appears in Dampier's *Voyage to New Holland, 1699.*



Straw-necked Ibis.

Two species of spoonbill (Plataleidae) occur in the swamps of northern and eastern Australia. Their name is derived from the curious form of the bill, which is employed in sifting aquatic vegetation. Both species are white. The Royal Spoonbill (*Platalea regia*) has a black bill and black legs, and usually nests in a swamp, in which it builds a flat, open structure of twigs and trampled reeds: in the Yellow-billed Spoonbill (*P. flavipes*) the bill and legs are yellowish, and the nest, built of sticks and lined with leaves, is placed in a tree.

The only representative in Australia of the stork family (Ciconiidae) is the Jabiru or Black-necked Stork (*Xenorhynchus asiaticus*) which is found throughout the coastal districts of northern Australia, its range extending thence to India. In Australia it is scarce and shy, but very noticeable when present; its black-and-white body, red legs, and large black bill show against the open patches near swamps where a solitary bird often stands silent or walks about for hours on end. It flies well, having a wing-spread of sometimes seven feet. Its nest, constructed of sticks, is a very large structure built in a tree, usually near a swamp.

Jabiru.

W.B.A.

Ichneumon-flies. See HYMENOPTERA.

Illegitimacy. This expression, used in relation to births, implies that they have occurred out of wedlock, and the word 'illegitimates' has been widely but inadvisedly employed to designate children so born. In Australian statistics, however, births occurring among the

'unmarried' (spinsters, or widowed, or divorced women) have for many years been tabulated as 'ex-nuptial' births. This term has the advantage of correctly defining the character of the births in question.

Each State of Australia is characterized by a different ex-nuptial birth-rate, which for convenience' sake may be expressed as a percentage of the total number of births occurring during the same period. Quinquennial averages of these annual percentages follow—figures for 1923 are added:—

Years.	New South Wales.	Victoria.	Queensland.	South Australia.	Western Australia.	Tasmania.	Northern Territory.	Commonwealth.
1901–5	6·99	5·63	6·53	4·17	4·22	5·80	.....	6·05
1906–10	6·70	5·70	7·27	4·21	4·21	5·52	12·75	6·06
1911–15	5·47	5·80	5·96	4·20	4·33	5·32	23·13	5·44
1916–20	4·92	5·51	5·29	3·89	4·00	5·41	22·36	5·01
1923	4·95	4·45	5·40	3·08	3·63	4·44	40·28	4·64

It is, however, by no means certain that these values afford an un-ambiguous measure of the degree of self-control in the several States, as a reduction of the percentage may be due to increased knowledge of contraceptives.

For the whole of Australia, the percentages since 1901 of ex-nuptial on total births have been as follows:—

1901	5·99	1909	6·01	1917	4·91
1902	5·82	1910	5·75	1918	5·23
1903	6·01	1911	5·79	1919	5·30
1904	6·17	1912	5·53	1920	4·84
1905	6·24	1913	5·48	1921	4·75
1906	6·23	1914	5·26	1922	4·49
1907	6·15	1915	5·12	1923	4·64
1908	6·16	1916	4·77		

These figures show that there is a well-defined decrease in Australian ex-nuptiality.

The number of ex-nuptial births per annum per 10,000 unmarried females of ages 15 to 45 (i.e. during the normal child-bearing period), occurring in various countries for the triennium 1900-2 are shown in the following table:—

Ireland	38
Netherlands	68
England and Wales	85
New Zealand	89
Switzerland	98
Australia	133
Scotland	134
Spain	155
Norway	172
Belgium	178
France	191
Italy...	194
Prussia	237
Denmark	242
Sweden	243
German Empire	274
Austria	401

The number of births among the unmarried varies according to age, and attains its maximum for ages 21-22, when it is 181 per 10,000. Among the married the maximum (4835 per 10,000) occurs at 18. Ex-nuptial births are relatively rare at any age, but it is a sociologically important fact that for females aged 16 and under the majority of births are ex-nuptial. Thus for the period 1907-14 the figures for mothers aged 12-16 were:—nuptial births, 1344; ex-nuptial, 2192.

Male births in Australia normally preponderate over female in the proportion of about 105 to 100. In the case of ex-nuptial births the proportion is somewhat smaller; for the period 1901-13 the nuptial proportion was 105.08, the ex-nuptial 104.17. The difference is so small that it may be accidental. The frequency of twins is distinctly less among ex-nuptial births than among nuptial, the rate being 1.023 per cent among nuptial and only 0.768 per cent among ex-nuptial. Triplets, however, are 55 per cent more frequent among ex-nuptial than among nuptial births—but this result depends on too small a number of cases to make it a reliable generalization.

Immigration Restriction. The Australian people are remarkably homogeneous in racial origin, over 97 per cent being of British stock. This homogeneity has been achieved by the adoption of a deliberate policy, gradually evolved, of restricting any large immigration of persons of a markedly different race-stock. Until recent years the only immigrants of different race-stock who sought Australia in considerable numbers were Asiatics; and the policy of restriction—now generally known as the 'White Australia' policy—when adopted by the Commonwealth government in 1901 was directed in fact, though not *eo nomine*, against Asiatic immigration. Such immigrants have in past years reached Australia in two ways: there have been (*a*) an intermittent introduction of Asiatics and Polynesians under contracts of service to settlers, the chief historical importance of which lies in the hostility it aroused among the 'working class' against all Asiatic immigration as the source of a cheap labour supply, and (*b*) movements of Asiatic adventurers into the Australian colonies, the first of which was the rush of Chinese to the Victorian goldfields in the early fifties.

That Asiatic immigration would be considered undesirable by Australians was certainly not anticipated by those who were chiefly responsible for the first settlement. James Matra (q.v.) pointed out on 23 August 1783 that any

number of useful Chinese immigrants might be induced to settle in Australia and to build up its prosperity, as they had in the Dutch Indies, and his suggestion was approved by Sir Joseph Banks. Sir George Young was also of the opinion that the development of the new colony would require only a small flow of population from Great Britain, as most of the settlers would come from the Pacific islands and China. Phillip, however, was not instructed to encourage Asiatic immigration, though he was advised to secure enough island women to serve the needs of the men under his control; he did not act on this advice. Wakefield (q.v.) in his *Letter from Sydney* (1829) reverted to the subject of obtaining Asiatic and island labour for Australia. Labour from this source might, he thought, at first supply the requirements of the settlers; but he pictured the time when Asiatic immigrants (especially Chinese) would convert the 'enormous wilderness' of Australia into a fruitful garden on their own account. In his opinion the only bar to a very rapid increase of the Australian people by means of immigration from China was the difficulty of securing female immigrants from that country. He drew the attention of his British readers to the commercial prosperity they would enjoy when they had a free market with millions of fellow-subjects of Chinese origin. But there was no free movement of Asiatics into the new colony, nor did the settlers make any concerted effort to take advantage of the labour reservoir of the Pacific so long as they had a sufficient supply of convicts. In a few individual cases Asiatics, especially Indians, were employed—for example in 1815 Simeon Lord employed three Bengalis, and in 1819 40 Indian servants were discharged by a bench of magistrates from the employ of William Brown, merchant, and were returned to India. During the thirties, however, the rapid expansion of the pastoral industry created a labour scarcity. In August 1836 John Mackay, an Indian planter of long experience, arrived in the colony, and at once suggested to Governor Bourke that steps should be taken to introduce hill coolies from Bengal, under a system of indenture like that in operation since 1833 in the Mauritius. A second memorandum from Mackay—who had meanwhile been in consultation with a number of pastoralists—was presented to the governor in October; he urged that half the cost of the proposed importation should be met by the government, and half by the pastoralists who received the coolies. The suggestions were widely discussed, and referred by the governor in June 1837 to a special committee of the legislative council, before which one witness stated that his partner in Madras had, two years previously, shipped to Albany in Western Australia a number of Madras coolies who had proved very satisfactory. But the general opinion of witnesses who knew India was that hill coolies from Bengal would be better suited to the pastoralists' requirements. Some suggested that Chinese should also be introduced as gardeners and household servants. There was considerable opposition to the proposal, especially on account of caste systems, paganism and miscegenation. Even its supporters characterized it as a temporary measure devised to meet emergency conditions that were not denied, since it was generally admitted that an immediate supply of 10,000 labourers was required to meet the shortage. In these circumstances the committee recommended that a government bounty of £6 be paid for every male hill-coolie from Bengal embarked before 31 December 1838, providing proper regulations for their transport were made, and 10s. sterling (exclusive of wages) deposited twice a year by employers to form a repatriation fund. By 1839 it would be known whether the experiment was likely to be a success. If a settlement were made to the northward for the cultivation of tropical products, the introduction of Indians on a larger scale would, the committee thought, become necessary. But Bourke was opposed to the scheme, did not consider the report sufficiently favourable to warrant the expenditure of public money, and declined to take official action. Private arrangements were nevertheless made with John Mackay for the introduction of coolies, and in August 1837 a batch of 41 was embarked in the *Peter Proctor*. An indenture-contract preserved in the Mitchell Library shows that they were engaged for five years at five rupees a month, with food and clothing as specified; at the end of their time a free return passage was to be provided if required. No bounty from government funds was allowed on these coolies. Large orders for men were placed in India during 1838, but the only record of arrivals is that of 40 men introduced for the Glenmore distillery. Perhaps, as the *Sydney Morning Herald* complained, 'the ceaseless clamour that was being raised in the colony' against the alleged ill-treatment of those already introduced had actually prejudiced further recruitment. In the following year the government of India (by Act XIV of 1839) suspended contract emigration from its territories, as the result of abuses to which the coolies were subjected in the Mauritius.

In 1837 pastoralists had been prepared to experiment with Chinese as well as with Indian labour, and in September orders were placed in Singapore for a shipment of Chinese coolies, treasury bills to the amount of £1500 being forwarded to cover preliminary expenses. But no shipment took place—owing, it seems, to the loss of the bills. In 1838 arrangements were made by Mackay to introduce Chinese, but his efforts too were unsuccessful. About the same time the *Sydney Morning Herald* gave publicity to a suggestion that labourers might be obtained at small expense from the neighbouring islands; there is no evidence, however, that the suggestion was then followed up. During 1839-40 there was a large inflow of European immigrants to the colony, and the labour scarcity was less urgent; but in 1840 transportation to the eastern mainland ceased, and it became obvious that convict labour must gradually be replaced somehow. On 22 July 1841 James Macarthur presented to the council a petition from a number of 'prominent citizens' for a thorough investigation of the coolie labour problem. There was nothing in the law to prevent the private introduction of Asiatic labour, but its advocates sought financial help from the government. A special committee, with Bishop Broughton in the chair, having reported against a government subsidy, the parties interested held a public meeting on 24 September 1842 at which, on a motion by W. C. Wentworth (q.v.), an 'Association to obtain permission to import coolies and other labourers from the East Indies' was formed. The Indian act of 1839 had been modified to allow a renewal of emigration under contract to the Mauritius; planters in the West Indies were agitating to have their claims considered, and the pastoralists of New South Wales now joined in the cry; and on 5 May 1843 Gipps

forwarded to the colonial office a petition signed by 686 prominent settlers (the inclusion of 104 magistrates was specially emphasized) asking for a concession such as had already been granted to the Mauritius. But the Coolie Association met with opposition both in the colony and in England. The working-men of Sydney made loud complaint against pastoralists who (as Henry Parkes wrote at the time) 'had been accustomed to having the convicts toil for nothing and they cannot bring their minds to paying for that of the free men.' Gipps had already, on 27 March 1843, forwarded to the colonial office a petition signed by 4129 persons opposed to the introduction of coolies, who argued that a grave injustice would be done to the free men who had come to Australia to better their condition, if they were forced into contact with the low-standard coolies of India. Gipps, while admitting the want of cheap labour in the colony, repeatedly declared that he would regret extremely the importation of Asiatics. James Stephen at the colonial office agreed with the arguments of the working-men, and in a minute prepared for Lord Stanley wrote: 'to gain the greatest possible amount of immediate profit on capital at the expense of any comparatively remote disadvantage, however great or however certain, is at once the policy and the calamity of the times in which we live.' Stanley agreed that the concession should not be granted, and that no public money should be spent on the introduction of Asiatics. It should be noted, however, that both the colonial office and the governor, though objecting to the proposals of the Coolie Association, were at the same time devising a project by which the establishment at Port Essington (q.v.) was to be developed by the encouragement of Malay settlers; it had been shown to their satisfaction that the climatic conditions of that settlement militated against the employment of Europeans for agricultural purposes. On 14 March 1844 Stanley approved this project and forwarded directions for the leasing of land to Malays, etc. The settlement was abandoned, however, in 1849.

Its petition having been refused, the Coolie Association could not openly recruit labour in India. Two shipments of coolies, to the number of 86, were introduced in 1844 on the pretext that they were to serve as domestics—who were exempt from the provisions of the 1839 act; at least one surreptitious shipment of 51 coolies was also made in 1846 under disgraceful conditions. But no extensive system could be built up in defiance of the law of India, so employers again considered the substitutes proposed in 1837-8—islanders and Chinese. On 9 April 1847 Captain Kirsopp, acting for Benjamin Boyd (q.v.), reached Twofold Bay with 65 young men from various islands in the New Hebrides group, who were to be tried out at pastoral work. The landing was opposed by local workmen; the islanders suffered considerably from climatic conditions; and there is no evidence that the experiment was repeated.

Attention now turned to China, where contract emigration from the southern seaports to various countries had been carried on since 1845. In July 1848 a consignment of 100 adults and 21 boys was shipped at Amoy for New South Wales through the agency of J. Tait, a coolie-merchant who found his influence as consul for Spain, Holland, and Portugal very useful in his business. The matter was brought to the notice of the governor of Hong Kong by the British consul at Amoy, who asked for extra-legal powers to act should the coolie-traffic at Amoy provoke a public disturbance; there were no serious riots, however, until 1852. The men under contract for New South Wales were engaged for 2½ dollars a month, and boys for a dollar and a half, with food rations 'as specified.' The British consul, though fearing the results of an extension of the traffic at Amoy, considered the experiment favourable for most of the coolies—'the bad portion of the population is provided for, the island is relieved of many thieves, and a good climate and decent support await them.' During 1848-9 270 Chinese were imported into the Sydney district, and 217 Chinese, Klings, and Malays into Port Phillip; but the climate of Port Phillip was unsuited to the experiment, the coolies were unable to do their work, and many of them were finally put into gaol as vagrants in a very distressed condition. Farther north the experiment was more successful, and later shipments were practically all consigned to the Moreton Bay district, though there were isolated cases of the introduction of skilled Chinese elsewhere; e.g. Thomas Glendinning of Melbourne introduced under contract Louis Ah Mouy, a builder, who later became one of the leading Chinese residents in Australia. Governor Fitzroy was advised by the colonial office to discourage the importation of Chinese, and no government bounty was paid on any of the shipments. During the early gold-rush, when white labour was practically unobtainable, pastoralists renewed their efforts to obtain Chinese, but the gold-fever spread to the Chinese themselves. There were, too, other reasons for dissatisfaction with Chinese labour. During the voyage out the mortality rate was high. When they found their wages were below the normal standard of the colony, they rebelled; they were continually absconding; when they were brought before the courts, the lack of interpreters proved an insurmountable difficulty; and their morale suffered from the anti-social circumstances in which they lived. Most were employed as shepherds, but some were set to work for a company on the Great Nugget Vein property. The Brisbane immigration officer was opposed to further importations. In 1854 a select committee on Asiatic labour estimated that 2400 Chinese had been introduced into New South Wales; their figures for Indian coolies, however, are provedly understated, and this number too may be unreliable.

The Chinese being enticed to the goldfields, pastoralists again considered the possibility of obtaining Indians. In 1852 the Madras Indian Emigration Society arranged, with the approval of the colonial office, the emigration of 60 Eurasians to New South Wales, and the experiment was repeated in 1854 when 101 arrived in the colony. In 1854, too, Henry Parkes introduced an additional 25 Eurasians as compositors for the *Empire*—an action which he always carefully (though not always successfully) distinguished from the attempts made by the pastoralists to get coolies. But the Eurasians were bred to city life and did not meet the requirements of the pastoralists, who preferred coolies. On 14 December 1852 Wentworth in the legislative council had proposed that the Indian government should be informed of the need for labourers in New South Wales, and of the desirable conditions that awaited them in that colony; without the co-operation of the Indian government nothing could be done, since Act XIV of 1839 had not been modified in favour of Australia. In the hope that India would yield to pressure Robert Towns (q.v.), acting as agent for a num-

ber of interested parties, made arrangements to send five ships to India for coolies. But the departure of four of the coolie ships roused the opponents of indentured labour to action. On 7 July 1854 Henry Parkes in the legislative council moved (but failed to carry) a number of resolutions against the introduction of 'a coloured or an inferior race for the purpose of temporarily supplying the existing want of labour;' on 15 August he obtained the appointment of a select committee to take evidence on the conditions under which coolies were introduced—the mortality on the Chinese ships had been specially heavy—and on the terms of the contracts, and to consider whether a colonial protectorate should be established to look after the interests of the coolies. But it was evident that no more Chinese could be obtained under contract while the gold-fever continued in California and Victoria; the Indian government refused to allow the emigration of its subjects, and the ships sent by Towns had to seek other cargo; and in these circumstances the committee reported that no official action need be taken in connection with coolie labour proposals.

The question of securing coloured labour was then in abeyance for almost a decade; as gold-digging became less remunerative, there was no great scarcity of labour. Between the early sixties and the advent of the Commonwealth, efforts to secure Kanaka, Chinese, and Indian indentured labour were made only for the tropical and subtropical districts of Queensland, the Northern Territory, and Western Australia. In 1863 67 kanakas were brought to Queensland by Robert Towns, who secured them through the agency of Ross Lewin, a sandalwood-getter and island trader, for cotton cultivation on his estate about 40 miles from Brisbane. In the following year about 54 were obtained by Louis Hope for sugar cultivation. The experiment was repeated by other agriculturists, and by the beginning of 1868 2017 kanakas had been brought into Queensland. But the abuses connected with their recruitment, transport, and subsequent treatment were already so great that the government was obliged to interfere. Under the provisions of the Polynesian act of that year no islanders might be brought to Queensland except by a licensed trader, and the licensee was required under bond to refrain from kidnapping and to return the labourer to his island at the end of three years; he was also bound to produce certificates, signed by a consul, missionary, or other well-known person in the islands, to the effect that the labourers had been voluntarily recruited. A register open to inspection by magistrates was to be kept by each employer. Inspectors were appointed to enforce the act; but they were for the most part magistrates occupied with other duties, their duties and powers were undefined, and inspection was regarded as optional, so that to a great extent the act remained a dead letter. Allegations of cruelty were still made, and in 1869 a committee was appointed to enquire into the working of the act. The committee recommended *inter alia* that a government agent should be carried on each vessel to supervise recruitment; the Queensland government had no authority to intervene in island affairs, and this was the only way in which they might secure some measure of control over the recruiters. It was not until February 1871 that the government, acting under pressure from Great Britain, issued regulations for the appointment of agents—but the agents apparently had a too limited authority, for the abuses continued. The British government was thereupon forced to intervene. During 1871-2 an officer of the British navy investigated charges of kidnapping; this was followed by an Imperial act for the prevention and punishment of criminal outrages upon natives of the islands, and five schooners were built for the navy in colonial ports to enforce its provisions. During the seventies, therefore, the kanaka traffic was controlled by the Queensland act of 1868, the regulations of 1871, and the Imperial act of 1872. In 1880 the Queensland parliament passed a new Polynesian labourers act, which amended and enlarged the provisions already in force; express power was given to the government to appoint agents.

No drastic action was taken until a series of outrages connected with the traffic occurred in New Guinea. As the labour supply in the several groups failed, or the enforcement of regulations became more effective, recruiters shifted their operations from the New Hebrides to the Solomons, thence to New Britain and New Ireland, and in 1884 to the New Guinea coast. It was common knowledge that the traffic was subject to abuse; indeed, Britain had already suffered the humiliation of a rebuke from the German government on this account, German lives having been endangered as a result of the intrigues of recruiters. In 1884 all traffic in arms was forbidden, and in the same year a royal commission was appointed by the Queensland government to investigate recruiting in New Guinea. Its report forced the Queensland authorities to forbid recruiting after 1890; meanwhile the lot of kanakas already in the colony was to be improved by the appointment of inspectors to supervise the conditions under which they worked. In 1891 9362 kanakas were still under contract in Queensland, out of a total 46,387 introduced since the beginning of the traffic. When in 1885 Samuel Griffith passed an act forbidding the importation of kanakas after 31 December 1890, it was hoped that by subdivision of estates, and the judicious encouragement of European immigrants, the sugar industry would survive the gradual withdrawal of kanaka labour. By 1890, however, Griffith was convinced that this hope could not be realized, and that if the sugar industry was to be maintained the prohibition against the further importation of kanakas would have to be rescinded. In 1892, therefore, despite protests from the other Australian colonies and from Great Britain, a resumption of the traffic was allowed under stringent regulations, which, *inter alia*, restricted the employment of kanakas to the cane-fields. Between 1892 and 1900 about 11,000 were taken to Queensland. When the Commonwealth came into being the federal parliament was given power to control immigration; public opinion throughout the continent tended to favour a White Australia policy, and in 1901 the first Pacific island labourers act was passed, empowering the federal authorities to deport any kanaka found in Australia after December 1906. Recruiting ceased in 1904, and preparations were made for the repatriation of those still in Australia; it was agreed that those who had lived continuously in the country for 20 years, those whose return involved risk either to themselves or their families because of a marriage contracted by them, the very old and infirm, and holders of freehold property should be exempt from the provisions of the act. After December 1906 3642 islanders were repatriated at a total cost of £31,473, of which Queensland contributed £17,570.

During the kanaka period planters did not entirely give up the idea of securing labour from Asia, either in addition to or as a substitute for the islanders. In 1874 enquiries were made by interested parties as to the possibility of securing Chinese coolies for the sugar plantations. Under the terms of the Emigration Convention of 1866 (between Great Britain and France on the one hand and China on the other), which was held to be effective by the Chinese government though it had not been ratified by Great Britain or France, Chinese emigration under contract was only permitted by the Chinese authorities if it were officially regulated by an agent of the government of the recruiting country. This obligation the government of Queensland was unwilling to assume. Moreover, in 1875 a great outcry arose in Queensland against the influx of free Chinese to the northern goldfields, and the importation of indentured Chinese would in these circumstances have been impolitic. About the same time attention was again directed to India as a labour reservoir. As early as 1862 an act had been passed in Queensland empowering the government to issue regulations for the introduction and protection of labourers from India. But the terms under which the government of India was prepared to allow contract emigration from its territory were very stringent, and in view of the possibility of an abundant kanaka supply no further action was taken at the time to secure Indians. In 1874 negotiations were revived, but without success. In 1882 Queensland, moved to action by the abuses which had occurred in the kanaka traffic owing to the difficulties of supervision, again approached the government of India and sent a representative to India to carry on negotiations. But there was considerable opposition in the colony both from the Liberal and the Labour groups; negotiations were discontinued, and an act was passed requiring the government to submit to parliament in advance any regulations issued in connection with Indian immigration. In 1886 the act of 1862 was removed from the statute-book.

When the kanaka traffic reopened in 1892, it was (as has already been said) stipulated that the imported labourers should be employed only in cane-fields; and planters, looking round for another labour reservoir to supply the requirements of other branches of the sugar industry, turned to Japan. In 1893 a large consignment of Japanese coolies was landed at Cairns, Townsville, and Mackay. Opponents of the traffic promptly urged in parliament that Japanese indentured immigration was more dangerous to the interests of the working-class and the colony than were the kanakas, since the Japanese traffic was unregulated (at any rate at the Queensland end), no limitation was placed on the kind of work for which the Japanese were indentured, and the terms of the contract were not publicly known. Moreover, the Japanese had a powerful government behind them, which might intervene to protect their welfare. Thomas McIlwraith, then premier, though denying that official encouragement was being given to the introduction of Japanese, admitted that he was in favour of the importation of alien labour for the sugar plantations, and pointed out that the Japanese would be employed only on work that had formerly been done by kanakas. Despite opposition, the importation of Japanese was continued on a comparatively small scale, the labourers being recruited either in Japan or on Thursday Island. During a debate on the subject on 31 August 1894 Hugh Nelson (who had become premier) pointed out that it was difficult to devise a restrictive scheme that would be acceptable to Japan, and ignored a proposal to penalize the importers. Negotiations were then opened with Japan through the British minister at Tokyo, on the basis that Queensland was prepared to become a party to the Anglo-Japanese commercial agreement of 1894, providing its right to regulate the admission of artisans and labourers was admitted by Japan. An agreement on these lines was reached in 1897, but the methods of regulation were not determined to the satisfaction of both parties until June 1899. No emigrant might leave Japan for Queensland without a passport, which would not be issued to labourers or artisans without the previous sanction of the Queensland government; further, private applications for imported labour must be submitted for official sanction. But by this time the whole question of Asiatic immigration to Australia was being hotly discussed all over the colonies, and the Queensland government had no mind to involve itself in turmoil over action that all the non-ministerial parties in the colony strongly opposed; it was therefore decided to refuse all applications for the time being. This decision called forth an immediate protest from the Japanese consul at Townsville, who insisted that his government had agreed to the regulation, not to the prohibition, of immigration into Queensland. Resident Japanese merchants, he said, were suffering from the government's decision, as well as the planters. On 18 November 1899 he suggested that the number of Japanese labourers in Queensland should be limited to the number resident in that year (i.e. four to five thousand); as contracts were completed the vacancies could be filled up by further importations to the limit agreed upon. He urged the government to make a decision as soon as possible, not only because the matter affected the *amour propre* of Japan, but also in the interests of 'the immigration companies whose sole business was to supply Japanese labourers to employers in this country.' In October 1900 the proposal was accepted in principle; the limit was fixed at 3247 (the official figure for resident Japanese labourers in 1898), and it was agreed that not more than 25 should be imported at any one time—a restriction later modified to allow shipments of 50. But importation on these terms came to an end as soon as the Commonwealth immigration restriction act of 1901 came into force.

Between 1870 and 1900 several proposals for the introduction of indentured Asiatic labour were made in South Australia and Western Australia. In 1874 the South Australian government sent an agent to Singapore to engage 200 Chinese for the Northern Territory for two years at three dollars a week or less. The coolies were to be employed either on public works or by private persons as directed by the government resident. A more far-reaching experiment under official sanction was made in 1886-9 when coolies (chiefly Chinese) were imported for the construction of the northern portion of the railway from Palmerston to Pine Creek; the whole of the unskilled work was done by them, as many as 3000 Chinese being employed on the line at one time. There is no record of the number of Chinese introduced on private account. Persons interested in the development of the Territory had since 1874 made several proposals for the introduction of Indians, and in 1879 the South Australian parliament passed an act to

authorize the introduction of Indian labourers into the Territory and to provide for the appointment of immigration agents in India and protectors of Indians in the ports of debarkation. These appointments were designed to meet the requirements of the government of India—which, however, did not consider the safeguards sufficient. More detailed regulations were drawn up in 1882, and a delegate was sent to India to join in the Queensland negotiations; nothing came of this, and a further effort to reach agreement was made in 1890 without success. In 1892 South Australia asked for an intercolonial conference to consider the problem of securing indentured coloured labour for tropical areas; but in Queensland, where the kanaka traffic had recently been resumed, the proposal was rejected.

In Western Australia attention was mainly given to the introduction of Chinese. The colony was not originally established as a convict settlement, and during its early years there were several shortages of labour; suggestions for the importation of Asiatics were made and they were probably introduced in small numbers. From 1850 to 1868 convicts supplied labour for the colony, but when transportation was abolished the cry for labour again arose. In 1874 a committee, appointed to consider the introduction of indentured Asiatics for the development of the pearling industry and of pastoral settlement, reported unfavourably on Indian labour, but advised the introduction of Chinese on a small scale. Following on this recommendation, Chinese were introduced unsystematically during the seventies at public expense. In 1880 the legislative council decided to allow an extension of the system; and, despite local opposition and protests from the eastern colonies, a few hundred Chinese were introduced annually during the eighties under the imported labourers registry act of 1884. This act provided for the registration of imported labourers, for the exclusion of those who, being old or infirm, might become a public charge (a number of Chinese were already being supported by public funds), and for the welfare and comfort of those imported. In 1893 importation was suspended because of local opposition, but was resumed in 1897 for areas north of 27° S. lat., in the proportion of one coolie to every 500 tons of shipping. In 1894 repatriation of coolies at the end of their term was made compulsory. In 1901 further importation was prohibited by federal law.

There is no indentured coloured labour in Australia to-day, except in the pearl-fisheries. This industry is mainly carried on from Broome in Western Australia and Thursday Island in Queensland, and to a lesser extent from Port Darwin in the Northern Territory. When the Commonwealth came into being, experiments were made with the substitution of white labour for the Japanese, Papuans, and Malays who by the end of last century had practically monopolized the pearling industry; these, however, were unsuccessful. Asiatics may indenture for the fisheries under special permits.

Unindentured Immigration of Asiatics.—Until the fifties of last century a few Chinese mechanics and merchants were the only unsought Asiatic immigrants Australia knew of: but as soon as news of the gold discoveries circulated in the southern seaports of China widespread interest was aroused, and many enquiries were made by men anxious to seek the diggings. Chinese speculators were always willing to extend to Australia the 'credit-ticket' system already in operation to Malaysia and California—a system under which the cost of transport was advanced at an exorbitant rate of interest (usually on the security of the persons of the debtor's relatives), and on the understanding that the creditor through his agents should exercise control over the debtor's activities until principal and interest were paid off. By 1854 about 2000 Chinese had congregated on the Victorian fields. Almost at once the European miners agitated against the 'influx.' They complained that Chinese mining methods prevented the ground from being reworked; they were jealous of the economic advantages which the Chinese gained, chiefly by their elaborate organization; they feared that the alien mass would increase beyond the control of the white community. A royal commission of 1855 recommended that Chinese immigration should be restricted by placing a limitation on the number of passengers that a vessel might carry, and by the imposition of an entrance tax, and in June an act gave effect to these recommendations. The number of Chinese passengers that a vessel might bring to the colony was limited to one for every ten tons of registered tonnage, and on every Chinese immigrant an entrance tax of £10 was imposed; the governor was also empowered to collect an annual residence fee from the Chinese to meet the cost of the 'protectors' who were appointed to look after their interests. The restrictive terms of the act were easily evaded by landing immigrants at Guichen Bay in South Australia, whence they walked overland to the Victorian fields. The number of Chinese in Victoria at the census of March 1857 was 25,424, but it was known that many who were moving about the colony had not been included in this figure; the colonial secretary, indeed, estimated that in June of that year there were 33,694 Chinese in the colony.

Meanwhile the agitation against the Chinese continued, and on 4 July a determined effort was made to drive them from the Buckland River field by the destruction of their property and attacks on themselves. An anti-Chinese league was formed next day by the Buckland miners, who invited the co-operation of all Victorian miners; but a general uprising was prevented by the firm action of the government, which despatched troops to the disturbed district. It was evident, however, that a recurrence of the trouble could only be prevented by further restrictions. Victoria therefore invited South Australia and New South Wales to pass restrictive acts on the lines of the Victorian act of 1855. The South Australian government did so, and early in 1858 a bill was introduced into the New South Wales parliament, but was rejected by the council. Victoria also passed in 1857 an act imposing a licence-fee of £1 (payable every two months) on every male adult Chinese miner; the proceeds went to pay the salaries of additional protectors, the cost of sanitary improvements at Chinese camps, etc. Chinese residents petitioned against the imposition of a residence tax, and begged the government to spare those already resident on the fields, whatever course might be taken to restrict further immigration. They were supported by the mercantile community, to many of whose members the transport of Chinese to Victoria had proved lucrative. In the end the acts of 1855 and 1857 were repealed by an act of 1859, which imposed a tax of £40 on Chinese arriving by land, and reduced the residence tax to £4 per annum. As a result of these measures the

number of Chinese in Victoria decreased from 42,000 in 1859 to 20,000 in 1863.

Many of the Chinese who had left Victoria congregated in New South Wales, which at the beginning of 1861 had (by census figures) a Chinese population of 13,000. As in Victoria, the influx was opposed by the European miners. In December 1860 there was a serious disturbance at the Lambing Flat diggings on the Burrangong field, and the Chinese were despoiled of their property and driven away: a second riot followed in January-February 1861, but ended with the arrival of the military and the departure of the Chinese to other fields. In September the government passed an act providing for restrictions on the lines of the Victorian act of 1855 and disqualifying Chinese for naturalization. This raised an important international question. The Convention of Peking, which had been signed in the previous year between Great Britain and France on the one hand and China on the other, besides conferring on the subjects of the contracting parties certain treaty-rights, included a special article on migration which had been inserted at the instance of Great Britain and France. Formerly emigration from China, though rarely impeded, had been technically illegal, though in 1859 the governor of Kwangtung had officially allowed it from that province. In order that British schemes for the operation of the system of contract emigration under official regulations might be developed, it was now declared in clause 5 (of the British version of the treaty) that 'Chinese choosing to take service in British colonies or other parts beyond the sea are at perfect liberty to enter into engagements with British subjects for that purpose and to ship themselves and their families on board any British vessel at any of the open ports of China.' It was thought that the ratification of this convention might affect the situation in New South Wales; but, though the colonial office objected to discriminative legislation which disqualified Chinese for naturalization, and considered any restrictions 'highly objectionable in principle,' the New South Wales act was nevertheless confirmed because of the 'exceptional nature of Chinese immigration.'

The agitation now died down, and, when the natural yield of the goldfields decreased, the acts were repealed by South Australia in 1861, Victoria in 1865, and New South Wales in 1867; nor did the 'Chinese question' again excite public interest until the rich goldfields of northern Queensland were opened up in 1875. Before the end of that year 7000 Chinese had taken out licences to work on the Palmer diggings. The European miners, already considerably outnumbered, secured the support of the southern workers, who opposed the immigration of Chinese because of recent proposals made by interested parties to import them under contract. Consequently in 1876 a goldfields act amendment bill was passed by the Queensland legislature, providing for the imposition on Asiatic and African aliens of a heavier fee for leave to mine or carry on business at the goldfields than was imposed on Europeans. Governor Cairns considered that this attempt to restrict immigration by discriminating against men already resident in the colony infringed the treaty-rights of the Chinese. He therefore reserved the bill; and the colonial office upheld his action on the ground that, although the fifth article of the convention of Peking referred only to Chinese emigrating under contracts of service, nevertheless 'the article contemplates that all Chinese subjects should have full freedom of entry into British dominions without special restrictions or impediments.' The assent of the Crown was therefore deferred. The despatch conveying this decision was angrily received in Queensland; the resident Chinese now totalled about 17,000, and it seemed as if the permanent interests of the colony were to be subordinated to the commercial ambitions of Great Britain. The agent-general in London was instructed to inform the colonial office that, though the people of Queensland valued the privileges they enjoyed as British subjects, nevertheless 'if we are called on to sacrifice our hopes of perfecting a community founded on the principle of social and political equality, we are not content to do so without a most earnest effort to avert such a calamity.' Meanwhile John Douglas, then premier, sent a circular letter to the other Australian governments asking for their co-operation, but they had at the moment no Chinese problem of their own, and public opinion was indifferent; Graham Berry, the premier of Victoria, agreed that 'the rights and responsibilities of self-government as possessed by law should be jealously guarded,' and Henry Parkes in New South Wales was prepared to back any 'well-devised and temperate measure.' Despite the general lack of support Queensland again (1877) passed the original bill with a few minor amendments, and enacted a Chinese immigration restriction bill on the lines of the Victorian act of 1855—with the added provision that the entrance tax would be returned if the immigrant left the colony within three years and had not during that period become a charge upon public funds. These acts were confirmed by the Crown, and during the next five years only 500 arrived in the colony.

Four colonies had thus dealt with the 'Chinese question' at different times, and had solved it temporarily by the adoption of similar restrictive measures. But there was as yet no fixed Australian opinion against the principle of Asiatic immigration. This developed first in the organized trade unions, which in the past had opposed all proposals for the importation of Asiatic indentured labour, just as they had opposed a renewal of transportation—and for the same reasons; they also opposed the immigration of free Chinese because their standard of living was lower than the Australian standard. But the opposition so far had no pan-Australian significance. In 1878, however, the Australasian Steam Navigation Company decided to employ Chinese seamen in some of their vessels. The company had its headquarters in Sydney, and as the vessels returned to port the crews were called out on strike by their union officials. The strike was supported by the unions in Queensland, New South Wales, Victoria, South Australia, and even New Zealand, and monetary assistance was generously provided. In Queensland, moreover, the government gave notice in January 1879 that the mail subsidy paid by it to the company would be discontinued. Under such conditions the strikers were able to hold out until the company practically ceded their demands and promised to withdraw the Chinese gradually. So strong had been the feeling aroused in the eastern colonies by the issue, and so obvious was the value of co-operation, that arrangements were made for the holding of an intercolonial trade-union congress in 1879. This congress *inter alia* condemned any import-

ation of Chinese workers, and called upon the government of New South Wales to restrict the immigration of Chinese by the imposition of an entrance tax. It was followed in 1880 by a conference of colonial premiers, to which Henry Parkes submitted a motion 'that in the opinion of this conference the grave consequences which must follow the influx of large numbers of Chinese call in a special manner for the concerted action of all the colonies, both in representation to the Imperial government and in local legislation.' At the time there was no special influx of Chinese into any of the colonies, but it was feared that the action taken by the United States to exclude Chinese immigrants would divert the tide to Australia. In Sydney an anti-Chinese league had been formed in the previous April, and there was sufficient agitation to induce the premiers to agree to introduce restrictive legislation. When their conference reassembled in January 1881 it protested against the decision of the Western Australian government to increase the importation of Chinese under contract. Subsequently acts restricting the number of Chinese passengers a vessel might carry to one passenger to 100 tons shipping, and imposing an entrance tax of £10 on each Chinese immigrant, were passed in Victoria and New South Wales, despite strong opposition from the legislative councils. In Victoria Chinese aliens were also debarred from voting at municipal or parliamentary elections. In South Australia the bill was modified to allow vessels to carry one passenger to 10 tons shipping, and to exclude the Northern Territory from its provisions. Queensland increased the stringency of its restrictive measures in 1884, when the passenger limitation was raised to one passenger to 15 tons shipping and the entrance tax to £30. Western Australia did not adopt a restrictive policy until 1886, and then only for Chinese not imported under contract. Tasmania fell into line in 1887. The colonial governments were apparently satisfied with the measures adopted, since the subject was not discussed officially at the colonial conference of 1887.

It must not be supposed that Australian opinion was already unanimous in favour of restriction. To Anglo-Australians like George Reid there was not 'the slightest doubt that the mere fact of treaties of friendship and commerce . . . . makes any measure of this kind a violation of the spirit if not of the letter of those arrangements.' There were others who still believed that the rights of man included freedom of migration. Interested capitalists maintained that without Asiatics the development of the semi-tropical areas of Australia would be impossible. But the 'White Australia' party was gaining ground.

Then occurred the crisis of 1888. Since the signing of an emigration convention in 1866 the Chinese government had taken a more active interest in its emigrants, and in 1887 a Chinese commission was directed to enquire into the conditions under which they were living in various European colonies. In May the commission visited Australia. When its report was presented, the Chinese ambassador in London was directed to protest to the foreign office against the 'exceptional and exceptionable laws' which some of the colonial legislatures had enacted against Chinese subjects. The Chinese note was forwarded by the colonial office to the Australian colonies early in 1888 with a request for explanation and comment. It was received with alarm and indignation. In January the government resident in the Northern Territory had called the attention of the South Australian government to the 'exceptional influx' of Chinese immigrants expected there within the next few weeks. A large number of Chinese had already been imported to work on the railway; it was now rumoured that thousands more were coming to exploit the ruby fields. There seemed good cause to fear a peaceful invasion and effective occupation. Parliament being in recess, the South Australian government issued a proclamation imposing a £10 entrance tax on all Chinese immigrants into the Northern Territory; all vessels from China were also to be placed in quarantine for 21 days—an order which resulted in the diversion southwards of several vessels originally destined for the Northern Territory. Meanwhile, the anti-Chinese party in the Northern Territory had sent an agent to the eastern colonies to arouse sympathy for their cause. About the same time the protest from the Chinese ambassador in London was received. There was a widespread belief in the colonies that Chinese emigration to Australia was about to take, with the approval of the Chinese authorities, a new and systematic form. When news of the approach of the *Afghan*, with a large Chinese passenger-list, was received in Melbourne, there was almost a panic, and the fear of an approaching 'invasion' was undoubtedly genuine. On 1 May a large public meeting held in the town hall agreed that the entrance tax ought to be raised to £100. The government, however, was able to deal with the incident under cover of the law. The *Afghan*, which measured only 1439 tons, was carrying 268 passengers; some of these presented naturalization certificates, but they were declared fraudulent, and the captain was given the option of taking the unfortunate immigrants to sea again or of paying the heavy fine he had incurred by carrying so many passengers in excess of the number allowed by law. He chose the former course, and made for Sydney, where the *Tsinan* with 204 Chinese passengers was already in the harbour; and two other immigrant vessels followed soon afterwards. The then premier, Henry Parkes, yielded to the demands of an agitated public and forbade the landing of all immigrants except those who had *bona fide* naturalization papers; for this action he obtained a parliamentary indemnity on the following day. Some of the Chinese held exemption papers showing previous domicile, and on behalf of these a writ of habeas corpus was obtained and they were allowed ashore. All others were excluded. Panic legislation providing for the imposition of an entrance tax of £100 on Chinese immigrants, and raising the passenger limitation to one passenger to 300 tons shipping, was rushed through the house of representatives, only to be held up by the council. Feeling against Britain ran high during this period, on the ground that the foreign office should have concluded with China an immigration treaty similar to that negotiated by the United States. But this was unfair; the foreign office could not act until it was fully informed of the situation in Australia, and some colonial replies to the Chinese note were not received in England until June. Meanwhile the Chinese ambassador protested against the 'arbitrary and irregular proceedings of the colonial authorities,' and demanded compensation for any losses sustained by Chinese immigrants. In the circumstances the colonial office welcomed a suggestion of the South Australian government that an intercolo-

nial conference should be held to consider the question in all its aspects. In June 1888, therefore, the Australian premiers met in conference; they had before them a telegram from the colonial office reminding them of the political and commercial relations of the Empire with China, and suggesting that they should meet the difficulty that had arisen by devising a measure 'equally restricting immigration into the colonies of all foreign labourers, with power of relaxing the regulations in certain cases.' If the colonies desired the negotiation of a treaty, they must not prejudice their case beforehand. The conference, however, rejected the proposal for general legislation, and decided that bills should be introduced to raise the passenger limitation to one passenger for every 500 tons shipping, and that the entrance tax should be dropped. Tasmania alone dissented. Henry Parkes, who had already introduced in New South Wales a bill sanctioning a poll-tax on immigrants, promised that the colony would fall into line when two other colonies had adopted the proposed measure—a promise which was not carried out. The premiers were determined to secure immediate restrictive legislation, but wanted a treaty also. The British ambassador at Peking was accordingly instructed to approach the Tsung-li Yamen with a view to obtaining a treaty similar to that negotiated by the United States; at the same time instructions were sent to the governors of Hong Kong and the Straits Settlements to suspend Chinese emigration to Australia. But the negotiations came to nothing, for a treaty was no longer necessary. As far as the colonies were concerned, the acts passed in 1888 proved effective. Moreover, in any future emergency they could act under the authority of a privy council decision—in the appeal of Musgrove *v.* Chun Teong Toy against a decision of the supreme court of Victoria. Chun Teong Toy, a passenger in the *Afghan* which had been turned away from Melbourne, had sued the collector of customs for refusing his proffered entrance tax and prohibiting his landing. The defendant denied that the money had been offered; but his contention was that, even had it been offered and refused, it was within the power of the Victorian government to exclude aliens from any Victorian port. Even if the exclusion were in excess of the Victorian government's powers, he maintained that this was not a question to be raised by an alien. The supreme court of Victoria decided that only the express powers stated in the constitution act of 1855, with such additions as were strictly necessary to give effect to those powers, had been vested in the colonial government; damages were therefore awarded to Chun Teong Toy. Before the privy council the appellant (the collector of customs) maintained that by the constitution act of 1855 and act 91 of 1859 a complete system of local responsible government had been established in Victoria, carrying with it such use of the crown's prerogatives as was required for local purposes, and especially for the preservation of the public peace. The privy council upheld the appeal.

Chinese immigration into Australia was now effectively restricted. Almost at once the colonists became aware of a thin stream of immigrants flowing into their midst from other parts of Asia. By 1891 there were, exclusive of Chinese, 2503 Asiatics resident in the several colonies, of whom 1800 were Indians, and a few Japanese. After 1893 the desirability of extending the Chinese restriction acts to all Asiatics was frequently discussed in public meetings, and occasionally in parliaments. The importation of Japanese by sugar-planters in northern Queensland increased the antagonism of the Labour party, and the intercolonial conference of premiers which met in 1896, to consider whether they should become parties to the Anglo-Japanese treaty of commerce and navigation (1894), agreed not only to reject the treaty but also to extend the provisions of the Chinese restriction acts to all Asiatics. Queensland alone dissented, and in 1897 became a party to the treaty under a proviso which reserved to the colony the right to restrict the immigration of artisans and labourers. New South Wales, South Australia, and Tasmania at once passed bills on the lines agreed upon, but they were vetoed by the crown. The proposed restriction of Indian immigration affected the unity of the Empire. The question of intra-Imperial migration had already been raised in connection with Indian immigration into Natal, where M. K. Gandhi was rousing Indian opinion against restriction. Moreover the *rapprochement* between Great Britain and Japan, which later developed into the Anglo-Japanese alliance, was already being fostered, and no colonial action that might impair these good relations could be allowed. The immediate and emphatic protests which had been made against the bills by Japan could not be ignored, especially as the Japanese government declared its willingness to negotiate a treaty providing for the restriction of Japanese immigration into the colonies.

The question was discussed at the colonial conference held in London in 1897, whereat Joseph Chamberlain, then colonial secretary, expressed the sympathy of the British government 'with the determination of the white inhabitants of these colonies, who are in comparatively close proximity to millions and hundreds of millions of Asiatics, that there shall not be an influx of people alien in civilization, alien in religion, alien in customs—whose influx, moreover, would most seriously interfere with the legitimate rights of the existing labour population.' But he asked the premiers to consider whether they could not achieve their purpose by a method less objectionable than the exclusion of immigrants on the grounds of colour or race; 'it is not because a man is of different colour to ourselves that he is necessarily an undesirable immigrant; it is because he is dirty, or he is ignorant, or he is a pauper, or he has some other objection which can be defined in an act of parliament, and by which the exclusion can be managed with regard to all those whom you really desire to exclude.' He submitted to the consideration of the Australian colonies an act recently passed in Natal, which embodied the principle of restriction by means of an education test. Any person who, when asked to do so, failed to write out and sign in a European language an application for admission in a form set out in a schedule to the bill was declared a prohibited immigrant. The Natal act had been allowed by the crown, and New South Wales, Western Australia, and Tasmania readily adopted the language test.

By 1901, though there was no general agreement as to the method of restriction, the principle was approved of by a large majority of Australians. The first federal parliament therefore set itself to give effect to the popular demand for the exclusion of Asiatics, and after much controversy the language test was agreed upon. Under the immigration restriction act (No. 17 of 1901) which embodied the 'White

Australia' policy, an immigrant might be required to write out at official dictation a passage of 50 words in any European language. It was understood from the first that European immigrants would not be required to pass the test. The Japanese government protested against an education test in any European language, considering that this distinction placed Japanese on an inferior footing; to soothe Japanese susceptibilities an amending act (passed in 1905) provided for the substitution of 'any prescribed language' for 'any European language.' But no regulations have been drawn up prescribing any language, so that the provisions of the original act are still *de facto* in force. A further clause in the amending act of 1905 legalized an informal arrangement, made in the previous year with Japan and India, for the admission of students, merchants, and other visitors on a passport system; in 1912 the same concessions were offered to China. Under the original act the officer in charge at any port is allowed, on receipt of a deposit of £100, to admit for a temporary period an immigrant who fails to pass the dictation test. Exemption is also granted to the crew of any vessel during its stay in an Australian port; but, if any of the crew who would be prohibited as immigrants do not rejoin the vessel, the master, owners and charterers become liable to a penalty of £100 for each prohibited immigrant conveyed to the colony. Asiatics indentured for the pearl-fisheries are exempted from the provisions of the act.

In the administration of a law which, owing to its many exemptions, was necessarily complex, and was made more complex because it was an attempt to achieve indirectly an object which could not be attained directly without hurting the feelings of friendly nations, it was natural that awkward and occasionally unpleasant incidents should occur. The customs officials in whose hands the administration lay were not always competent to handle delicate situations, so that a few immigrants were at first illegally detained or subjected to unnecessary hardships. Many Europeans who might have become immigrants were dissuaded by the belief that the dictation test might be applied to them, as from the purely legal point of view it could have been; but it must be remembered that this test was forced on a reluctant Australian government by the colonial office for diplomatic reasons, and that prime minister after prime minister publicly disclaimed in parliament and elsewhere any intention of applying it to Europeans—nor has it ever been so applied. Again, the exclusion policy was in parliament a matter of party politics, though the Australian public was every day more emphatic in its favour; such incidents as did occur, therefore, were given full publicity and sometimes exaggerated in the partisan press. The most notorious of these incidents was the *Petriana* case, which deserves mention here just because a distorted account of it was widely circulated throughout the British Empire. The *Petriana*, an oil-carrier from Borneo with a crew of Chinese and Malays, was wrecked off Point Nepean in Port Phillip on 28 November 1903. On the 30th efforts to float her were abandoned; the crew was brought to Williamstown in a tugboat, embarked during the afternoon in a Japanese mail-steamer, and left for their homes (in Borneo or China) on 2 December. This procedure was the outcome of several conversations between the *Petriana's* agents and the under-secretary for external affairs, who was in touch with the prime minister, and who informed the agents that 'provided the men were placed in some situation where they might be kept under supervision until an opportunity arose for their deportation, no objection would be taken to any merely technical infringement of the law.' The government offered accommodation at either of the two Victorian quarantine stations, which were at the time empty; the agent's representative refused, but suggested that it might be possible to arrest the crew as prohibited immigrants and so detain them in gaol; this suggestion was promptly rejected, and the under-secretary in his turn suggested that they should be at once embarked in the Japanese vessel in which passages had been engaged for them. This was immediately done. Unfortunately federal elections were to be held on 16 December, and during the intervening fortnight many totally false statements appeared in the partisan press—one even attributing to the government the proposal to gaol the crew. Unfortunately these sensational absurdities gained a world-wide circulation.

On the whole the policy of Asiatic exclusion, except for exempt classes, has been effectively enforced. Since the inauguration of the Commonwealth the Asiatic population of Australia has decreased; in 1901 47,014 Asiatics were resident, but in 1921 there were only 28,087, including 17,009 Chinese, 2860 Hindus, 2856 Syrians, 2738 Japanese, and 1083 Malays.

Other Restrictions on Immigration.—Though the most important provisions of the act and its amendments especially affect Asiatics, federal officials are empowered to exclude from Australia certain other classes of immigrants whose presence in the community would have an injurious effect upon its welfare. These include anyone suffering from a physical or mental infirmity, or who from any other reason is likely to become an economic burden upon the community; anyone who has within three years been convicted of an offence (not being a mere political offence) and has been imprisoned for one year or longer therefor and has not received a pardon; or any prostitute or person living on the proceeds of prostitution. The original act further prohibited the entrance of immigrants under contract or agreement to perform manual labour within the Commonwealth except (*a*) crews of coasting vessels employed at the ruling rate of wages, (*b*) persons exempted by the minister as possessing special skill needed in Australia. This additional prohibition was placed in the act by Labour influence, reports having reached Melbourne that there was a large influx of contract immigrants to Western Australia for work in the mines and to Queensland for work on the cane-fields. Its administration caused even more trouble and discontent than the exclusion of Asiatics. It was sometimes taken by critics as applying to domestic servants, sometimes to workers of all kinds so long as they came out under contract—both interpretations being, of course, incorrect and invariably repudiated by the government. It was challenged by employers of labour as an interference with freedom of contract, and often obeyed with the utmost recalcitrance. The incident which occasioned most comment was that connected with six hatters who left England under contract to a Sydney manufacturer before the act became law, and had therefore obtained no permit to land. During the voyage the act came into force, and on arrival their permit was demanded. Their employer objected to the

demand, and the men were detained aboard until he complied with the law. Exaggerated stories, representing that they had been expelled from the Commonwealth, went the rounds of Europe. Owing to these and other misunderstandings the Deakin ministry in 1905 introduced a separate measure to deal with contract immigrants, and so worded it that the mistakes due to vagueness of language could not be repeated. Under its provisions the admission of immigrants under contract to perform manual labour is permitted only if the contract is in writing, is made by or on behalf of some person named who must be resident in Australia, and is approved by the minister. Such approval—which must be obtained before the immigrant lands in Australia—will not be given if the contract is made to affect an industrial dispute, or if the remuneration and other terms offered are not as advantageous to the immigrant as those obtaining for workers of the same class at the place where the contract is to be carried out. If the proposed immigrant is not a British subject born in the United Kingdom (or a descendant of such a person), the employer has also to show to the satisfaction of the minister that it is difficult to obtain a person of equal skill and ability in the Commonwealth. If a contract labourer is introduced into the Commonwealth contrary to the provisions of the act, the contract is void, and the immigrant and employer are both liable to penalties; the employer may also be required to maintain the immigrant until he obtains employment, or to pay his return expenses to his country of origin.

Additional restrictions were introduced by an amending act which came into operation on 2 December 1920. It prohibits the entry of (*a*) any person who advocates the overthrow by force or violence of the established government of the Commonwealth or of any State, or of any other civilized country, or of all forms of law, etc.; (*b*) for a period of five years, any person of German, Austro-German, Bulgarian, or Hungarian parentage and nationality, or Turk of Ottoman race; (*c*) any person over 16 years of age who, on demand by an officer, fails to prove that he is the holder of a valid passport; (*d*) any person who has been deported under any act.

Within the last two or three years it has become evident that Australia must expect an increasing immigration from Europe consequent upon the restrictive policy adopted by the government of the United States. Though the provision for a language test in the immigration act was couched in general terms, it was definitely stated by more than one prime minister that European immigrants would not be subjected to it. Providing they satisfied the medical authorities and were not contract immigrants the entry of most Europeans into Australia was unrestricted until quite recently. Small groups of Maltese had entered the Commonwealth before the war without administrative interference; but in 1916 rumours were circulated in Australia that an effort would be made by interested parties to introduce 'cheap labour' to take the place of the men withdrawn from industry for active service abroad. Soon after the rumours became current, a French mail-steamer was reported off Fremantle with about 200 Maltese immigrants aboard. W. M. Hughes, then prime minister, being anxious not to prejudice the conscription issue then before the people, informed the captain of the vessel that the immigrants would not be allowed to land; and so for almost six months the unfortunate Maltese, taken first to New Caledonia by arrangement with the French government and later brought to Sydney and detained on a hulk in the harbour (no transport being available to return them to their country of origin), suffered much distress until they were finally admitted under certain guarantees of employment. The incident roused much public hostility, and the government decided that no more Maltese would be admitted during the war; but after protracted negotiations an agreement was reached with the government of Malta whereby 260 Maltese—the average number of Maltese admitted to Australia during the last triennial period before the war—were to be admitted annually. This closed the incident temporarily. In January 1923 the arrival in Sydney of about 300 Italians, most of them destitute, brought the question of Italian immigration into public notice. They were returned to Italy, and an agreement was made with the Italian government by which the latter undertook to issue passports for Australia only to persons possessing capital or nominated by friends in the Commonwealth. Meanwhile the Maltese government had endeavoured to reopen negotiations on the subject of the quota restriction for Maltese, which was being used by certain anti-British elements in Malta as propaganda against British rule. The question was discussed at the Imperial conference of 1923, and an understanding was arrived at on the lines of the Italian agreement—with the additional provision that not more than 20 Maltese immigrants would be permitted to land from the same vessel or during the same month at any one port; illiterate Maltese would be admitted only by special permission obtained from the minister in charge, on the application of friends in Australia.

The tentative restriction of European immigration by agreement with the governments concerned was extended at the end of 1924 to cover intending immigrants from Greece, Jugo-Slavia, and Albania. Not more than 100 immigrants of each nationality will be admitted to the Commonwealth in any one month, and preference will be given to immigrants with a knowledge of English who possess capital or friends in Australia. Queensland in 1925 appointed a royal commission to investigate alien immigration as it affects that State.

See M. Willard's *History of the White Australia Policy* (1923) and P. Campbell's *Chinese Coolie Emigration to Countries within the British Empire* (1923).

Imperial Conferences. This title, properly speaking, belongs to the conference of 1911 and its successors; but it is conveniently applied (following the precedent set by Sir A. B. Keith) to its predecessors also.

The occasion of the first colonial conference (that of 1887) arose naturally out of the events of the time. In 1881 an intercolonial Australian convention had considered restrictive legislation to check the immigration of Asiatics; in 1882-3 alarm at the apparently aggressive policy of France and Germany in the Pacific islands had led to the attempt of Sir T. McIlwraith (q.v.) to annex New Guinea; this had been disavowed by the British government in spite of Australian unanimity in his support, and the disavowal prompted the holding of another convention in Sydney in 1883, out of which issued the Federal Council of Australasia. In 1885 the effects of a brief but agitated anticipation of war with Russia were felt almost as

vividly in Australia as in the mother country; the colonies realized that 'foreign complications' might affect them also, and turned their attention to the necessity for strengthening their own defences. Further, the affairs of Egypt had culminated in a dramatic military campaign in which Canadian and Australian troops had participated; and the patriotic action of the colonies in offering contingents of troops made some impression on the British public. Nor were the other British colonies entirely at rest; in Canada a local uprising had been suppressed by the militia after some fighting, and the aftermath of the South African war of 1881 was a bitter competition between Rhodes at the Cape and Kruger (who was seeking foreign support) in the Transvaal. At this juncture the Imperial Federation League took advantage of the Indian and Colonial Exhibition in London (July 1886) to hold a conference, largely attended by colonial visitors, at which commercial union and a joint system of defence were advocated. On 11 August the league urged on the then prime minister (Lord Salisbury) the summoning of an official conference, with a view to the creation of an Imperial council. On 25 November a despatch from the colonial secretary to 'Governors of Colonies under responsible government' suggested 'fuller consideration of matters of general interest,' such as military defence and the promotion of commercial and social relations by development of postal and telegraphic communications. 'What is known as Political Federation' was expressly deprecated. The constitutional position of the proposed conference was defined clearly. It was to be purely consultative; it was not material that the colonies should have equal or proportionate representation; but it should be sufficiently representative to include, in addition to the agent-general or other specially deputed representative of each government, any leading public man who might be at liberty to come to England, and might be especially qualified to take a useful part in the deliberations. Copies of the despatch were sent to governors of the crown colonies, but not to the viceroy of India.

At the opening meeting Great Britain was represented by the colonial secretary, the prime minister and seven other ministers; Canada by the lieutenant-governor of Ontario and Sandford Fleming; Newfoundland by its premier and Sir Ambrose Shea; New South Wales by Sir Patrick Jennings (an ex-premier), Robert Wisdom (ex-attorney-general), and Sir Saul Samuel (agent-general); Victoria by Alfred Deakin (chief secretary), James Lorimer (minister of defence), Sir Graham Berry (agent-general), and James Service (an ex-premier); Queensland by Sir Samuel Griffith (premier) and Sir James Garrick (agent-general); South Australia by John W. Downer (premier) and Sir Arthur Blyth (agent-general); Western Australia by John Forrest (commissioner of crown lands) and Septimus Burt; Tasmania by John S. Dodds (an ex-attorney-general) and Adye Douglas (agent-general); New Zealand by Sir F. Dillon Bell (agent-general) and the speaker of the legislative council; The Cape Colony by its attorney-general, its agent-general and Jan Hofmeyr; Natal by John Robinson. There were also present 33 representatives of 23 crown colonies, and 54 other British and colonial representatives. The attendance totalled 121 representatives of 35 governments; but subsequent business meetings were practically confined to the representatives (or some of them) of the self-governing colonies and of the British departments immediately concerned with the matter under discussion, whatever it might be. The session (20 meetings) lasted from 4 April to 9 May, and a complete official report was published in July. The matters discussed included naval defence, preferential trade, commercial treaties, sugar bounties, postal and telegraph communication, and the situation in the Pacific. Naval defence (as was intended by the British government) occupied the greater part of the session. As far as Australia was concerned, the discussion resulted in an agreement (discussed under NAVAL DEFENCE) under which the Australasian colonies hired a small squadron for local defence.

Arrangements were concluded for the annexation and administration of south-eastern New Guinea, and for maintaining the neutrality of the New Hebrides; and the principle of strengthening inter-communication by means of a cable across the Pacific was approved, though no definite procedure was arranged. The work of this conference was doubly handicapped. The representatives of the various colonies had no time to become acquainted with each other or to arrange a programme of business; and they were in any case so heterogeneous a mixture of ministers, ex-ministers, agents-general, and private citizens, that they could not speak with any semblance of authority on behalf of their colonies. They were, in fact, not unlike an assembly of feudal vassals, invited to confer with their overlord. The colonies took good care that this situation should never recur in London.

The Ottawa conference of 1894 developed from the informal resolutions in support of a Pacific cable that were passed in 1887. Although it was called by the Canadian government, not by the colonial office, and was intended specifically to discuss trade relations and telegraphic communication between Canada and Australia, all the self-governing colonies were represented except Western Australia and Natal, which were unable to send delegates, and Newfoundland, which was apparently not invited. This conference was much less informal than the first; at Ottawa only two delegates were neither ministers nor members of a legislature—and these two were Sandford Fleming, who had special knowledge of the cable question, and Lee Smith of New Zealand, which colony looked upon the conference as a commercial one. Lord Jersey represented the Imperial government. Three ministers and Sandford Fleming represented Canada, one minister New South Wales. South Australia sent its agent-general. The Cape delegation again included Jan Hofmeyr, but its three delegates, like those of Victoria (3), Queensland (2), Tasmania (1), and New Zealand (1), held no ministerial office.

With regard to trade relations and preferential trade this conference recommended 'that provision should be made by Imperial legislation enabling the dependencies of the Empire to enter into agreements of commercial reciprocity, including power of making differential tariffs with Great Britain or with one another,' and recorded 'its belief in the advisability of a customs arrangement between Great Britain and her colonies by which trade within the Empire may be placed on a more favourable footing than that which is carried on with foreign countries.' As for the Pacific cable, it was resolved that 'immediate steps should be taken to provide telegraphic communication by cable, free from foreign control, between the Dominion of

Canada and Australia,' and that the Imperial government should be requested to undertake as soon as possible the thorough survey of the route, the expense to be borne in equal proportions by Great Britain, Canada, and the Australasian colonies.

An 'All Red' mail service was also discussed, as were the law of copyright—shelved because Lord Jersey mentioned that a committee on copyright was sitting in England—and the harmonizing of the bankruptcy laws of the various States. Like the first, this conference (owing to its composition) lacked authority. After 12 months' consideration of its resolutions, the British government announced that Imperial reciprocity would provoke foreign retaliations, and bring serious difficulties to the colonies as well as disaster to Britain. Intercolonial trade preference was condemned; in fact, the colonies were told, politely and emphatically, that Mamma knew best.

The conference of 1897 resembled that of 1887 in so far as it was incidental to an Imperial festival and a Royal Jubilee; but, both in form and in conclusions reached, it marked a decided stage in the development of the Imperial conference as an institution.

For the first time, albeit by accident, the colonial membership was confined to premiers of responsible governments; for the purpose of the Jubilee ceremonial premiers alone had been invited and thus were alone available for the conference. On this occasion, therefore, for the first time the conference assumed the shape, since stereotyped, of an assembly of autonomous governments, collectively the rulers of the whole Empire. Joseph Chamberlain, then colonial secretary, presided; the premiers present were Sir Wilfrid Laurier (Canada), G. H. Reid (New South Wales), Sir George Turner (Victoria), Sir Hugh M. Nelson (Queensland), C. C. Kingston (South Australia), Sir Edward N. C. Braddon (Tasmania), Sir John Forrest (Western Australia), R. J. Seddon (New Zealand), Sir J. Gordon Sprigg (The Cape Colony), Harry Escombe (Natal), and Sir William V. Whiteway (Newfoundland).

Chamberlain in his inaugural address proposed the formation of an Imperial council. He received no support from the colonial premiers; but from this time forward the alternative ideas of (*a*) developing the conference itself into the nucleus of an Imperial organization, (*b*) converting it into an advisory council, if not superseding it altogether, were frequently discussed by publicists and the press. The matters dealt with during the conference included colonial defence, preferential trade, Imperial penny postage, the Pacific cable, and colonial relations with foreign countries. It was agreed to prolong the Australasian naval agreement of 1887, and the Cape Colony came forward with the offer of a naval subsidy. With regard to trade, the premiers recommended the denunciation of treaties that might hamper commercial relations between Great Britain and her colonies, and undertook to consider whether preference could be given by the colonies to products of the United Kingdom. The future administration of British New Guinea, the Solomon Islands, and the New Hebrides was discussed privately with the premiers concerned. It was further agreed that periodical conferences would be of great value, and that colonies united geographically should where practicable form a federal union. Before the next conference met, Australia had demonstrated her acceptance of this last resolution, and the colonial units of the conference were thus reduced from eleven to six—a far more workable committee of the Empire.

Like two of its predecessors, the conference of 1902 was incidental to an Imperial festival —on this occasion the coronation of King Edward. The subjects indicated by the British government were the political and commercial relations of the Empire and its naval and military defence, but the colonial governments were invited to submit additional subjects for discussion. The representation of the self-governing colonies was not restricted to their premiers; the Australian minister of defence and four Canadian ministers were present, but took part in the discussions only when their special subjects were touched on. Britain sent Joseph Chamberlain, still secretary for the colonies, and the ministers concerned with naval and military defence. New Zealand, The Cape Colony, Natal and Newfoundland were represented by their premiers. There were ten sessions, lasting through June and July.

The chief subjects under discussion were naval defence, preferential trade, and the continuity of the conference system; in regard to the last it was arranged that conferences should be held every fourth year. Preferential trade was approved as a colonial measure—i.e. the colonies agreed to give preferential treatment to British goods and products of countries within the Empire. As for naval defence, the Australasian agreement was altered in a way that suited neither side. The auxiliary squadron disappeared; the colonial contributions became a mere subsidy—which was very displeasing to Australian feeling, and a year later wrecked the Barton ministry in the Commonwealth; and the admiralty (which had hoped that the Imperial spirit shown in the South African war would have elicited lavish contributions from the colonies) was disappointed both with the smallness of the subsidies and with the concurrent condition that Australasian sailors should be trained alongside British sailors at higher rates of pay. Minor and vaguer resolutions approved of mail-services across Canada, mutual protection of patents throughout the Empire, cheap postage, and the adoption of the metric system. In his opening speech Chamberlain advocated the formation of 'a real council of Empire, to which all questions of Imperial interest might be referred,' but the suggestion fell flat. It was, however, taken up afterwards by enthusiasts in England, who in 1905 persuaded Alfred Lyttelton (then colonial secretary) to suggest to the self-governing colonies the formation of an Imperial advisory council; but Canada and Newfoundland objected at once, and no more was heard of the suggestion officially.

The trend of British politics now brought preferential trade into the centre of Imperial politics. In the conference of 1907, therefore, it became the chief subject of discussion. This conference had been postponed for a year by the British government, but proved by far the most important held up to that date. Two subsidiary conferences, one convened by the board of trade in advance of the main conference to discuss Imperial navigation laws, the other by the board of education afterwards to discuss that subject, added to its prestige. Australia through its prime minister Alfred Deakin, took the lead in suggesting subjects; her list included, besides preferential trade, the desirability of establishing an Imperial secretariat, new proposals for the naval defence of the Pacific, and

the reorganization of the colonial office so as to give its officials fuller personal knowledge of the colonies with which they had to deal.

The British prime minister, Sir Henry Campbell Bannerman, opened the conference, but at later meetings the colonial secretary presided. Ten other members of the British cabinet attended when subjects within their purview were being discussed. From Canada Sir Wilfrid Laurier brought his ministers of defence and marine, the former being Sir F. Borden. Deakin was accompanied by Sir W. Lyne. Dr. Jameson from the Cape Colony brought his minister for works; New Zealand, Natal and Newfoundland were represented by their prime ministers only. The assistant ministers, of course, took part only in debates on their own subjects. In this conference Deakin asked for full publicity, but Sir W. Laurier suggested that (as in 1902) only the bare resolutions should be published at once, and a full report issued at the end of the conference. Lord Elgin demanded privacy. Eventually a compromise was agreed on—that a summary should be prepared and issued daily by official secretaries (each member being given a chance of revising his remarks), and a full report issued at the end of the conference; but the plan was not well carried out.

The session opened on 15 April and closed on 14 May. Of the 15 days spent in actual conference five were occupied with preference and five with constitutional and defence discussions. As regards preferential trade, the conference (with the exception of the British government) confirmed the resolutions of 1902; the British government finally and absolutely rejected Imperial reciprocity in any shape. On the constitutional point it was resolved that a conference—to be called the 'Imperial' Conference—be held every four years, all prime ministers and the British colonial secretary being *ex officio* members; governments might appoint additional ministers, but (except by permission) not more than two representatives from one government should join in each discussion, and each government should have but one vote. A permanent secretarial staff should be appointed. Provision was also made for subsidiary conferences. Respecting defence it was resolved that the colonies be authorized to ask the committee of Imperial defence, through the secretary of state, for advice on any local questions; a desire was also expressed for an Imperial general staff, to study military science and disseminate to the various governments military information and intelligence.

Many other subjects—including intra-Empire migration, penny postage, the 'all red' mail route, double income tax, copyright, and the New Hebrides convention—were discussed and vague resolutions passed thereanent; it was decided to hold a subsidiary conference on naturalization; and Deakin urged the British government to prepare a statement showing colonial obligations in respect of British treaties. But one of the most important of the Australian suggestions—that concerned with an Imperial secretariat—was misapprehended and mishandled until its adoption produced more irritation than it was worth. The original suggestion was to set up in London a secretariat consisting of expert officials from all the self-governing colonies, who would be in close touch both with their own and with the Imperial government, and should be consulted as to facts whenever a question of Imperial (as opposed to purely British) importance came up for settlement. These officials were not to be politicians or to have the power of committing their government to any decision; they were there for information, to enable both sides to avoid mistakes about fact. But between the jealousies of the colonial office—which objected to the intrusion of any outside body into affairs it considered its own—and the praiseworthy but impracticable aspirations of Imperial enthusiasts who wanted to set up a ministerial council in London, capable of committing colonial governments to political decisions (the old Imperial council under a new name), Deakin's secretariat came to nothing, and the colonial office was allowed to create a secretariat of its own, with no special personal knowledge of colonial affairs, that became merely a mechanism for maintaining connection between one conference and the next.

In 1909 a very important subsidiary conference dealt with questions of Imperial defence. An agitation for the increase of the British navy, in view of the growing naval power of other nations, had led to several unco-ordinate offers from colonies to provide battleships for Imperial use (see NAVAL DEFENCE); the situation was an embarrassing one for the British government, partly because it had no particular desire to admit colonial governments to a share in its naval policy, partly because it was evident that the offers were not a spontaneous expression of each community's unanimous good will. A conference seemed the best way out of the imbroglio; the result of it was to disclose great differences of opinion among the dominions (as the self-governing colonies were now called). Canada proposed to establish a small auxiliary squadron of light cruisers and destroyers, New Zealand maintained her prime minister's offer of a battleship (to be added to the British navy and placed on the China station), and Australia adopted wholeheartedly a suggestion made rather grudgingly by the admiralty that she should provide and maintain one 'unit' of a Pacific fleet, the other two units being provided by the British government as the China and East Indies squadrons. South Africa, which was still unfederated, postponed its decision until the Union should be accomplished. The military side of the conference decided that dominion forces, while remaining wholly under the control of their own government, should be as far as possible standardized in formations, training and equipment on British army patterns. It was through its representatives at this conference that the Australian government made its first protest against the failure of Great Britain to consult the Commonwealth with regard to the Declaration of London—an important international agreement. Another subsidiary conference in 1910 discussed Imperial copyright.

The conference of 1911 was a marked advance on all its predecessors. The British government had at last begun to realize that the self-governing colonies stood apart from the bulk of colonies administered by the colonial office, and must be treated as semi-independent entities within the Empire; and the admission of the change was marked by calling the conference for the first time an 'Imperial' conference and by placing it formally under the presidency of the British prime minister as the conference of 1907 had desired. Held after the agreed-on four-year interval, it fortunately coincided with the coronation of George V, and its prestige was enhanced by the accompanying

ceremonials and the presence in London of distinguished visitors from all the world over. Britain was represented by the prime minister (Herbert Asquith) and the secretary for the colonies (Lewis Harcourt), eight other cabinet ministers attending when the discussions entered their sphere. Canada sent its prime minister (Sir Wilfrid Laurier) with his ministers of defence and marine. From Australia came the prime minister (Andrew Fisher) with the ministers for defence and external affairs. Sir J. Ward brought his attorney-general from New Zealand; General Botha his ministers of education and works from South Africa; Sir E. P. Morris his colonial secretary from Newfoundland. The proceedings lasted from 23 May to 20 June, during which time eleven formal meetings were held, besides many secret meetings that must be discussed separately. The conference was further notable because three of the dominions—Australia, New Zealand, and South Africa (which by this time had become a Union)—practically took charge of the business paper. The Australian government put forward (among others) resolutions concerned with naturalization, migration within the Empire, trans-Atlantic cable communications, the Declaration of London, the status of dominion navies, and the general co-operation of British and dominion defence forces. New Zealand was also much interested in cable and mail communications; but her chief resolutions dealt with the establishment of an 'Imperial Council of State,' the substitution of high commissioners for governors-general as the sole channel of communication between the British and the dominion governments, and the complete reconstruction of the colonial office. South Africa wanted British relations with the dominions taken wholly out of the hands of the colonial office and placed immediately under the British prime minister; she was also interested in naturalization, and had a complicated scheme (which came to nothing) for balancing her contribution to naval defence against her preferential treatment of British goods. So, indeed, did most of the New Zealand proposals, which had obviously not been thought out; the Council of State was condemned all round, and the reorganization of the colonial office was shown to be unnecessary. The Australian objections to the Declaration of London produced a remarkable situation. The Australian prime minister began by declaring that the dominions ought to be consulted before the Imperial authorities bound them to obey international agreements; this was amicably settled by a British offer to consult the dominions in future 'when framing the instructions to be given to British delegates' at the Hague and to other international conferences. But the British ministry took advantage of this amicable spirit to attempt to obtain from the conference a resolution explicitly approving the Declaration itself. To this the Australian delegates strenuously objected. Extreme pressure was brought to bear on them, the British ministers desiring particularly to secure colonial approval of their diplomacy, to be used as an argument in the struggle which they foresaw over the Declaration in the British parliament. In the end the Australians yielded so far as not to vote against the resolution; they deliberately abstained from voting at all, and their attitude was fully justified when in the early months of the war it was attempted to put the Declaration into practice. Some agreement was arrived at in connection with questions of naturalization, but in respect of most of the other questions raised the results of discussion were either vague or non-apparent.

But the distinguishing event of the 1911 conference was technically altogether outside it. The discussion of naval and military affairs was formally relegated to the committee of Imperial defence, of which the colonial ministers were made members; and it thus became possible to explain to them fully and clearly both the secrets of British foreign policy and the British view of the international situation, on which all sound defence policy must be based. This deliberate admission of colonial ministers into the *arcana imperii* was welcomed by them as acknowledging irrevocably the right of the dominions to take a share in the direction of Imperial policy, and foreshadowed the Imperial war cabinet that was developed in the stress of fighting six years later. The immediate effect of the disclosures on practical defence measures was not great, though of course it led to increased zeal in standardizing all Imperial defence forces. The two dominion navies, also (if the term may be applied to such small squadrons), were brought into intimate relations with the British navy; they were allotted 'stations' for the defence of which they became responsible, they were given permission to fly the white ensign, and the personnel was made interchangeable with that of the British navy.

Although Imperial foreign policy was for the first time reviewed in detail at the conference of 1911, no adequate provision was made for keeping Dominion premiers in touch with foreign affairs during the intervals between conferences. The British government merely undertook to consult them on any treaties under consideration 'as far as possible and when time and opportunity and the subject-matter permit.' This was obviously unsatisfactory, and proposals were made for the appointment of resident ministers in London who could act as liaison officers. In 1912 the colonial office invited the Dominions to appoint such ministers; but the proposal was received coldly except in Canada (where Sir R. Borden was in office), and nothing further was done towards Imperial co-operation until the war had run two years of its course. The conference due in 1915 had been, of course, postponed; yet there was a general and insistent demand from the Dominions for some share in the responsibility of directing a struggle which concerned them so nearly.

The change, when initiated, was of great moment. One of the difficulties in the way of closer co-operation had been the fact that until the end of 1916 the conduct of the war was in the hands of the British cabinet, which was also responsible for the purely domestic policy of Great Britain: in such a cabinet the Dominions could claim no representation. But, when Lloyd George at the end of 1916 organized a war cabinet, the way was open for Dominion premiers to join it. An Imperial war conference was thereupon summoned, and two Imperial bodies were organized.

In March 1917 the first Imperial war cabinet was formed by adding the Dominion prime ministers to the British war cabinet—on which W. M. Hughes (q.v.) thus became the Australian representative; this body deliberated upon the larger issues connected with the war and its conduct, and exercised definite executive functions. In it Dominion members were on an absolute equality with the British, having full powers of question, examination, and initiation hitherto reserved to the chief ministers of the

British government. Each Dominion had its full share in determining military and foreign policy, especially in connection with the peace. It was resolved that the Imperial war cabinet should meet annually during the prosecution of the war; in fact, it met again in June-July of 1918, and then immediately after the armistice, remaining in continuous session (as the British Empire Delegation) until peace was signed.

The second Imperial body which met in 1917 was the Imperial war conference, a much larger and less responsible body without executive power. Presided over by the colonial secretary, it discussed war problems of minor importance, and Imperial problems apart from the war. The most significant debate of 1917 was that on the future constitution of the Empire, culminating in a 'constitutional resolution' that the readjustment of the constitutional relations of the component parts of the Empire, being too important and intricate a subject to be dealt with during the war, should form the subject of a special Imperial conference to be summoned as soon as possible after the cessation of hostilities. Any such readjustment, while thoroughly preserving all existing powers of self-government and complete control of domestic affairs, must be based upon a full recognition of the Dominions as autonomous nations of an Imperial Commonwealth, and of India as an important portion of the same; must recognize the right of the Dominions and India to an adequate voice in foreign policy and in foreign relations; and must provide effective arrangements for continuous consultation in all important matters of common Imperial concern and for any consequent concerted action. After debate in the conference of 1918 the war cabinet resolved that Dominion prime ministers should have the right (*a*) of direct communication with the prime minister of the United Kingdom, and vice versa, in reference to questions of cabinet importance, and (*b*) of nominating a cabinet minister to represent them at meetings of the war cabinet between plenary sessions. But the peace negotiations brought the prime ministers back to Europe before any action could be taken on this second resolution.

The Empire was represented on the supreme war council of the Allies by the Imperial (not the British) war cabinet, and thus any Dominion prime minister had the technical right to attend meetings of the council quite apart from his position as the representative of a small nation. The self-governing units of the Empire were now politically organized as a group of autonomous states, united on a basis of complete constitutional equality under a common Crown. This changed status was very evident in the conference of September 1921—'the conference of Prime Ministers of the United Kingdom, the Dominions and India,' the colonial secretary being present on behalf of the crown colonies and protectorates. This unwieldy designation was adopted in preference to 'Imperial cabinet' (which to the Dominions signified a central executive removed from popular control) or 'Imperial conference,' a term identified with the pre-war conferences in which Dominion equality was not fully recognized. The conference of 1921 was not merely informed about foreign affairs; it was admitted to be the body responsible for formulating Imperial policy. Particular attention was paid to the situation in the Pacific, and action was taken to secure an exchange of views at an early date with the United States and Japan with regard to the limitation of naval armaments—though nothing came of this until the United States called a conference at Washington. Consideration was also given to questions of Empire settlement, the position of British Indians domiciled in the Dominions, improved transportation facilities, etc. The special conference on constitutional relations was not called; the subject was discussed, but it was considered better, under existing conditions, to postpone any attempt to define the existing relationship by a political formula.

The latest Imperial conference, which met in October 1923, was similar in character to that of 1921. Its importance was enhanced by the holding of an 'Imperial Economic Conference' at the same time; this considered an extension of Imperial preference to secure for Dominion products special treatment on the English market, the related question of oversea settlement, proposals for British financial assistance of developmental works within the Empire, the improvement of mutual trade and Imperial communications, co-operation for technical research and information, etc. The political conference concerned itself primarily with foreign affairs. An important resolution concerned the negotiation, signature, and ratification of treaties. Its effect was that bilateral treaties imposing obligations on one part of the Empire only should be negotiated and signed by a representative of the government of that part; where a bilateral treaty imposed obligations on more than one part of the Empire the treaty should be negotiated and signed by one or more plenipotentiaries on behalf of all the governments concerned; in the case of treaties negotiated at international conferences, the existing practice of signature by plenipotentiaries on behalf of all the governments of the Empire represented at the conference should be continued. The conference agreed to the British proposal that a special service squadron (including two capital ships) should visit the British possessions in the Pacific, proceeding via Suez and returning via Panama. The conference also noted the deep interest taken by Australia, New Zealand, and India in the development of a naval base at Singapore, which would ensure the naval mobility necessary for the security of Imperial territories and trade in the East. Questions relating to the position of Indians resident in various parts of the Empire, to protected and mandated territories, and to the law of British nationality were also considered.

See A. B. Keith's *Responsible Government in the Dominions* (1912), *Imperial Unity and the Dominions* (1916), and *War Government of the British Dominions* (1921); and Richard Jebb's *The Imperial Conference* (1911).

Indian. This adjective is used in conjunction with a few European plant-names to denote certain Asiatic and Australian plants supposedly resembling their namesakes. For the Indian almond see TERMINALIA; Indian coral-tree, ERYTHRINA; Indian mulberry, MORINDA.

Indigofera, a large genus of the family Leguminosae, consisting of herbs or shrubs, chiefly dispersed in warm regions; several of the species indigenous to Australia extend to India. The flowers are red or purple, in spikes; pod elongated, cylindrical or angular, with cellular partitions between the seeds. *I. tinctoria,* a native of northern Queensland, produces the indigo of commerce. *I. enneaphylla* is regarded in India as a diuretic and febrifuge.

Industrial Disturbances. See STRIKES.

Industrial Law in Australia consists mainly of three elements: (*a*) the *Inherited Element*, that part of the existing law which was brought to Australia by the first settlers; (*b*) *Remedial or Ameliorative Statute Law*, a heterogeneous body of statute law, either developed locally or derived from the remedial legislation of the United Kingdom which followed in the wake of the industrial revolution in England, the Chartist movement, and the reform bill of 1832; (*c*) the *Law of Industrial Arbitration*, a new and experimental branch of law in which New Zealand and Australia have been pioneers —though one source of it is found in the socialism of 'Young Oxford' as exemplified in the writings of Arthur Hugh Clough.

The *inherited* element consists of so much of the common law as relates to contracts of employment and the parties to them, with some statutory modification. When the doctrine of freedom of contract was at its height (about 1860-1885 in the legislative history of Australia), this common law element was of somewhat greater importance than it is to-day. But it is still vastly important; for, though statutes and industrial awards regulate certain conditions of employment, parties still enter into and dissolve their own contracts, and the accepted legal theory is that the relationship of employer and employee is governed by contract made between the parties, the terms of which are mutually agreed upon—subject, however, to express legislation or awards directly in point. Moreover, for parties not affected by legislative interference the fullest freedom to contract remains, and parties within the scope of industrial arbitration may make agreements not contravening appropriate awards or other legislation. In fields untouched by industrial legislation the common law governs; e.g. it is not necessary to prohibit slavery by statute, because the common law will not allow imprisonment by a master of a servant, nor will equity protect a contract savouring of slavery. Again, contracts in restraint of trade are illegal at common law upon grounds of public policy, and this extends to contracts restrictive of a man's right to work at his calling; for the state has an interest in the producing power of its citizens, and a man is not allowed to contract himself out of the right to maintain himself at his proper calling in his own country. So well accepted is this ground of illegality in common law that the Australian law courts (as well as English and American courts, wherever the common law prevails), have, by a series of precedents and without legislative interference, defined with great precision the limits within which restrictive contracts will be enforced, and the appropriate remedies, if any. It would be a simple matter to multiply instances of the operation of common law in this field.

The inherited statutory modifications of the common law are noteworthy. From the time of the statutes of labourers (passed after the 'black death,' cf. 25 Edw. III Stat. 1) there has always been a certain amount of labour legislation in England. See Jenks's *History of Politics* (xiii, 137) and the introduction to Smith's *Law of Masters and Servants* (xxxviii sqq.). In 1828 the English law then in force, so far as it was reasonably adapted to the circumstances of the colony and capable of being enforced here, was expressly applied to New South Wales by 9 Geo. IV c. 83. Among the statutes so applied was the Masters and Servants Act, which was amended and revised locally from time to time. The effective remains of this and all early colonial legislation on the subject is found, for New South Wales, in the Masters and Servants Act 59 of 1902, a consolidating act. Many of the provisions of this act are counterparts of the English statute 4 Geo. IV c. 38 (A.D. 1823), since consolidated in England in the Employer and Workman Act of 1875. Its main features are the provision of summary remedies in the magistrates' courts, —for masters against servants who break their agreements, conduct themselves fraudulently in the obtaining of contracts of employment or the breach thereof, or wilfully spoil or destroy—and for servants against masters and masters' agents who fail or delay in paying wages or improperly withhold servants' property, etc. The language and remedies of the act are somewhat old-fashioned and drastic, but its benefits are considerable, and its remedies in constant use. Similar law obtains in other States, but not always under the same name; in Queensland it is the same, but in Victoria, owing to more recent revision and consolidation with other statutes, its form is more modern, and it forms a part of the Employer and Employees Act No. 2646 of 1915—an act that embraces other matters, such as employers' liability and contractors' debts, which in some States are the subject of separate statutes.

The *remedial or ameliorative statute law* is found in the legislation of the various States; except in respect of seamen, there is none of it in the Commonwealth statutes. Nearly all the beneficial legislation of the United Kingdom which was passed from 1830 onwards, to remedy the state of affairs which developed in factories, coal-mines and the like in England in the first quarter of the last century, has been adopted by some or all of the local State legislatures: e.g. the Truck Act, the Coal Mines Regulation Act, and the Factories and Shops Act. Of this class, too, are the Mines Inspection Act, Miners' Accident Relief Act (now superseded), Children's Protection Act, Apprentices Act, Attachments of Wages Limitation Act, Coal Lumpers' Baskets Act, Scaffolding and Lifts Act, Early Closing, Saturday Half-holiday, Contractors' Debts, and Shearers' Accommodation acts. All the foregoing are titles of New South Wales statutes. In Queensland the Shearers' Accommodation Act becomes the Shearers' and Sugar Workers' Accommodation Act, and the Contractors' Debts Act (not known in England) becomes the Workmen and Contractors' Lien Act; in Victoria it is consolidated in the Employer and Employees Act (mentioned above), and there are substantial differences of matter as well as of title. It is thus impossible to describe this multiform legislation, even in broad detail, for any one State of the Commonwealth, much less for all. The titles of the acts indicate their scope. All are not found in every State. Some are designed for purely Australian habits and conditions and originated here. Upon the whole it may be said that the enactment of the greater part of this legislation was due to the rise of the Labour party in Australian politics. Some of the English laws which are reproduced in this list did not find their way on to the Australian statute-books till long after they were first enacted: the Truck Act (New South Wales) No. 55 of 1900, which prohibits the payment of wages in goods and makes them payable in money only, was enacted first in Australia in that year, though based on the English statute of the same name of 1831 (1 and 2

Will. IV, 37); and this statute, not altogether suited to sparsely settled countries, has not been adopted in all States.

With this group of statutes may be classed those dealing with workmen's compensation. The Employers' Liability Act, passed in England in 1880, was enacted in almost identical language in all the States of Australia. It is now repealed, or in effect superseded, in Australia as in England by the Workmen's Compensation Act, which, as enacted in the various States, follows closely its English model and proceeds upon the novel principles of that act. Questions of negligence or contributory negligence on the part of employer or employee are passed over as irrelevant (except under the head of serious and wilful misconduct), and rights to compensation are provided for all cases of personal injury caused to a workman by accident arising out of and in the course of his employment. The latest New South Wales statute (act 71 of 1916 as amended by No. 45 of 1920) is the most liberal in its compensations. It applies to practically all employees except those whose remuneration exceeds £525 per annum. For Victoria see act No. 2750 of 1915 as amended by No. 3217 of 1922, which embraces workers on wages and persons employed otherwise than in manual labour, if they are not getting more than £350 per annum.

Each State has its own system of *industrial arbitration*, all differing from that of New Zealand. All are directed against sweating, and are in general attempts to improve the condition of workers and to provide peaceful methods of settling or preventing industrial disputes. In addition there is the Commonwealth system. It is proposed here to offer some explanation of the Commonwealth system, and of those of the two most populous States, New South Wales and Victoria; the systems of other States are merely indicated. Development has been great and continuous. Under no government has the progress of the arbitration system been really checked; yet strikes have not been avoided. Industrial arbitration continues to find a general acceptance by the public, and this is no doubt due to the fact that it deals with much besides strikes.

With regard to the avoidance of strikes not many minds will agree as to what the lessons of experience are, but it is tolerably clear (*a*) that it is inexpedient to legislate upon the footing that striking is in its nature an offence to be dealt with by ordinary criminal law, (*b*) that punishment for industrial offences should be developed as far as possible from within the system, e.g., in deprivation of the benefits of the system, and (*c*) that fuller education of the public is needed regarding civic rights and duties, in order to promote resistance to anti-social action.

The Commonwealth of Australia has power by its parliament to make laws for the peace, order and good government of the Commonwealth with respect (among other things) to 'Conciliation and arbitration for the prevention and settlement of industrial disputes extending beyond the limits of any one State' (Constitution Act, sec. 51 p. xxxv). In the exercise of this power the Commonwealth Conciliation and Arbitration Acts 1904-1921 were enacted. During the 17 years mentioned in the title nine amending acts have been added to the original and principal statute. The chief expressed objects of the act are to prevent lockouts and strikes; to create a Commonwealth court of conciliation and arbitration, endowed with jurisdiction for the prevention and settlement of industrial disputes; to provide for the exercise of the jurisdiction of the court by conciliation and, in default of agreement, by equitable award; to enable States to refer industrial disputes to the court, and permit the working of the court and the State industrial authorities in aid of each other; to encourage the organization of industrial bodies and the submission by them of their industrial disputes to the court; and to provide for the making and enforcement of industrial agreements between employer and employee. In practice, the court has in the main been occupied in the making of industrial awards, or in obtaining industrial agreements with the aid of its power to summon parties to a compulsory conference.

The high court has often been appealed to to decide whether a course of action or an award proposed by the Commonwealth court of conciliation and arbitration is in accordance with the principal act and the constitution, and also as to the validity of sections of the act. In particular, the high court has held that a provision purporting to empower the Commonwealth arbitration court to declare its awards to be common rules in the industries to which they relate is invalid; and this condition, though improved by an amending act, has somewhat restricted the development of that court, whose awards are in this respect inferior to those of State courts. Wherever an employment is governed by a Commonwealth award and a State award, both awards must be obeyed if possible. Awards which prescribe differing minimum rates of wage for identical work can both be observed by paying the higher rate (*Whybrow's Case (No. 1) 10 C.L.R. p. 266*).

The Commonwealth court has dealt with many industries of an inter-State character, e.g. those of seamen, ships' officers, engineers and stewards, wharf-labourers (where, though the individual labourers are local, they work for employers engaged in every State and whose ships move from State to State), and shearers, who move from State to State though their employers are in the main localized. The inter-State character of these industries is obvious; but after the Builders' Labourers' case it became plain that any industry can be treated as having a dispute extending beyond the limits of one State by the extension of the union organization into the federal sphere and the device of making similar or identical demands from employers in more than one State. In such a case the court can determine that a dispute within its jurisdiction has in fact arisen, and the high court will not interfere by writ of prohibition (*The Builders' Labourers' Case 18 C.L.R. 224*); nor will the privy council, on appeal from the high court, go into the question—since the Constitution forbids appeals to the privy council upon questions, howsoever arising, as to the limits *inter se* of the constitutional powers of the Commonwealth and those of any State or States. The high court may, of course, give a certificate allowing such an appeal, but did not in the case quoted. And the later case of the Amalgamated Engineers *v.* Adelaide S.S. Coy. shows that certain instrumentalities of State governments (e.g. railways, water boards, and trusts and corporations with similar functions) are subject to the federal industrial power. Thus Commonwealth awards can be applied in any industry, but cannot be made rules common to the whole industry. Still, if the employers are limited and definite, they can all be joined as respondents, and, if all

the employees were in the union affected, the result would be equivalent to regulation by common rule. Since these conditions rarely concur, the Commonwealth awards are imperfect in their application, while the system is in other respects less adaptable than those of the more important States. But the number and importance of the industries dealt with in the Commonwealth court is very great. Attempts made by the State governments from time to time to restrict these by some form of compromise or arrangement with the federal government have not as yet borne fruit. The high court in its decisions on appeal has, latterly, been keenly appreciative of the sense of the legislature in endowing this court with the completest power the constitution will allow. Recent attempts to curb the authority of the Commonwealth court of conciliation and arbitration upon the ground of *ultra vires* have been unsuccessful.

This beneficent interpretation, and the wide language of the statutes on which the court is founded, give it far-reaching power and cause much awkward overlapping of federal and State awards. In addition the Commonwealth court has gone very far in its reading of the word 'industry;' this is essential to the extensive jurisdiction which it has attained. Not only are many State services held to be industries and capable of industrial disputes 'extending beyond the limits of any one State' *ut supra*, but all grades of municipal employees, musicians, journalists, bank officials and those in the employ of insurance and trustee companies are held to be employees in industry. Further, no limit has been set by the legislature to the amount of wages or salaries which the court may fix in its awards; in many cases salaries of £700 per annum and more have been made the subject of an industrial award.

New South Wales.—Industrial arbitration was first introduced into New South Wales by the Industrial Arbitration Act of 1901 (Wise's act). This act created a court, consisting of a judge and assessors, which made the necessary industrial awards. An award was made between parties to a dispute; when this was done, a fresh substantive application could be made to the court for an order making such an award a 'common rule' in the industry.

This court was so much used as to become congested. The duration of the act, however, since it was admittedly an experiment, was limited to seven years, and in 1908 the Industrial Disputes Act (Wade's act) took its place. Under this act the court worked with a subject set of industrial boards, popularly known as 'wages boards'—the term being borrowed from the wages boards system of Victoria, then already in force (see below). The boards were created from time to time as required, and made industrial awards upon the application of bodies of employees, or employers of at least 20 men. All awards were subject to appeal to the court. The boards were miniature courts, consisting of a neutral chairman—usually a lawyer—and laymen assessors, one or two a side, representing employers and employees in the industry; they were subject to the control of the court in their creation, the marking out of their jurisdictions, dissolution and otherwise. Awards when made were common rules for the industry or portion of the industry to which they were directed, usually for a period of three years. This statute removed some defects that had appeared in the Wise act, and avoided the congestion of the court by the creation of boards as required, to each of which a single substantial business was entrusted. The act was several times amended. An amendment which had great notoriety, and a substantial effect on the future of arbitration, was made by the Industrial Disputes (Amendment) Act (No. 26 of 1909), which soon became famous in State politics as the 'leg-iron' act. This act was in itself an honest attempt to cure one of the weaknesses of industrial arbitration by making more effective the law against lockouts and strikes; but excess of zeal on the part of some policemen, who had in their charge persons under arrest for the offence of instigating a strike, led them to put leg-irons on the prisoners, and the incident gave rise to a political cry designed to assist in winning the next election for the Labour party.

In 1912 the Wade act was repealed, and replaced by the Industrial Arbitration Act of 1912 (Beeby's act), which preserved industrial boards, but arranged them in groups each under a single chairman; the building trades formed a single group, and the iron trades, leather trades, and manufacturing and transport industries became separate groups also. In all there were about 24 groups of boards, and more than 200 awards in force at a given time. The Beeby act further provided merely a monetary fine for the offence of instigating persons to strike. But awards can be rescinded, boards dissolved, and unions de-registered if not worthy of the advantages of industrial arbitration. Beeby's act also made elaborate provision for conciliation committees, which, however, have not yet been much used. Nevertheless a great deal of conciliation went on and continues, (*a*) within the board system, resulting in awards by consent of parties, and (*b*) outside it, by means of industrial agreements, which when registered are recognized by both earlier and later statutes as operative with the force of awards between the parties making them. It may be doubted whether the regulations under which the boards were instituted sufficiently encouraged this; indeed, their procedure, which resembled that of law-courts, was thought by many to be productive of the opposite result.

All this time the size and expense of the system had been steadily growing. In 1916 an amending act (No. 81 of 1916) made provision for more judges, in the hope that the hearing of cases and making of awards by single judges, doing the work of boards, would prove a quicker and less expensive system. Soon the work of industrial boards as then constituted was completed, and all new work was taken over by the judges, who may sit with assessors (but this has not been usual) or may, instead of dealing with applications for awards, refer any application to a board. Hence boards were kept in existence, but under the recent policy are inactive. Applications are in theory made to the boards, but really to the court. So far three judges have succeeded in doing all the necessary work.

A notable development of the system was made in 1916 by the repeal of the schedules to the principal act which had described and limited the persons for whom the act was intended. The sphere of industrial arbitration was at once widened to embrace employees for hire or reward in any craft, occupation or calling, and their employers. This is subject to very few exceptions. The Crown is included as an employer; but by further amendment in 1922 employees

under the Public Service Act of 1902 have been, like the police, excluded; and managers generally are outside its scope. Further extensive amendments were made in 1918—No. 16 of 1918—(*a*) by way of improvement of the existing legislation, perfecting the powers of judges, (*b*) adding a part (VIIa) dealing with the management, rules, funds and membership of trades unions—and three entirely new parts (IX, X, XI), each of which represents a substantial addition to the system. Of these, part IX provides for a board of trade, to which the most extensive powers of enquiry and recommendation in all kinds of socio-economic matters are given, as well as the power (and the duty) to declare the 'living' wage to be paid to adult male and adult female employees in the State, or in any defined area. Such declarations are rapidly translated into awards and become the basis of future awards or industrial agreements. This board has also power to control and direct the conditions in all respects of apprenticeship in any industry. Indeed, it could become a very great power in the State, but recent policy has somewhat limited its activity. Part X deals with the organization of the labour market by state labour exchanges, and the regulation of private employment agencies. Part XI provides for the initiation of a scheme of insurance against unemployment.

A typical industrial award contains from ten to twenty clauses, and is framed and interpreted in much the same way as an act of parliament, but the industrial court (which is of final authority in the interpretation of all awards) has power of its own motion at any time to vary an award. The usual clauses of an award prescribe (1) the area where the award shall apply; (2) the usual hours of work, by the day or week, as the case may require; (3) the minimum wage, by the hour, day or week (or for piecework)—this clause may be simple if it deals with employees all of one class or grade, or complicated to provide for seniors, juniors, apprentices, youths, female labour or a great variety and classification of workers in the same industry—(4) overtime rates of pay; (5) holidays, and the pay for them if worked; (6) apprentices' conditions, etc; (7) rules as to the time and mode of paying wages, if any; (8) termination of employment. Clauses may also be found with provisions peculiar to the industry in question—e.g. in the building trades, to provide for the sharpening of the workman's tools, the safety of the lock-up, and travelling time and money, where thought fit; in the shop-workers' awards (where pay is by the week) clauses deal with absence without leave, lodging with the employer, etc.; and special clauses and exemptions for particular phases or sections of the industry are added if need be. Finally, the duration of the award may be for any period up to three years. The validity of all special clauses depends, other things being in order, upon whether they deal with industrial matters (see definition below).

The award comes into force upon gazettal and is thereafter policed by the self-interest of the parties to it and by the department of labour and industry, which has a body of inspectors for the purpose. Breaches of award are punishable, and back wages are recoverable in the court of the industrial magistrate, subject to appeal to the industrial court.

The *'Court of Industrial Arbitration'* is the full style and title of the court established by the acts now in force. Known under the act of 1901 as the court of arbitration, in 1908 recreated as the industrial court, it has from 1912 been known by its present title. It consists of a senior judge with special rights and privileges, and three additional judges. In reality the court has been continuous since 1901, Mr. Justice Cohen, the first arbitration judge, having been succeeded by Mr. Justice Heydon before the first act lapsed, and that judge having continued to occupy the bench to the end of 1918. The office of industrial registrar created by the earlier acts was under the supervision of the minister for justice. It has now developed into a department of labour and industry, under a minister and a permanent under-secretary. It is charged (*a*) with the administration of the Industrial Arbitration Act of 1912 and amending acts; (*b*) with that of a great deal of industrial legislation outside the arbitration system, notably the early closing acts, factories and shops acts, gas act, workmen's compensation act and many others; (*c*) with the maintenance of a centre of public intelligence with regard to industrial law and certain economic features of industries, the publication of the *Industrial Gazette* and *Labour Exchange Supplement*, the control of various State agencies for labour exchange, the provision of labour for government works, and the training of women and youths for rural employment, relief, etc. In this department is housed the board of trade created by the amending act (No. 16 of 1918) already described. The *Industrial Gazette*, first issued in July 1912, was prepared and edited by the industrial registrar; it published all awards in force in New South Wales at the time of the commencement of the act of 1912, and all new awards published up to 1 July 1912, with a compendium, and has been continued as a monthly publication ever since.

In New South Wales 'industrial matters' mean matters or things affecting or relating to work done or to be done, or the privileges, rights or duties of employers or employees in any industry, but not involving questions which are or may be the subject of proceedings for an indictable offence. Particularly the phrase includes wages, allowances or remuneration of persons employed in any industry, or the piecework contract or other price payable in respect of such employment; the allowance or forbidding of piece-work or any other system of payment by results, etc.; the hours, age, sex, qualifications or status of employees, and the modes, terms and conditions of employment; the employment of children and young persons, the giving of preference to unionists, and any established usage or custom in any industry.

It is perhaps in relation to wages and hours that the facts of industrial awards are most forced upon public attention, though the utility and effect of award provisions upon other matters is probably of even greater importance. How great the increase of wages has been, the two following instances will show. In Newcastle Wharf-labourers' Union *v.* Newcastle and Hunter River S.S. Coy. Ltd. (*New South Wales Arbitration Reports*, vol. i. p. 1)—the earliest reported case of the court as first constituted in New South Wales—it is recited in the judgment of the president that 'the men in February 1900 formed themselves into the ———— Union, and in May 1900 struck for an increase of wages and shorter hours, which resulted in the Company granting a wage of 42s. per week of 60 hours, with overtime at the rate of 1s. per hour after 60 hours and of 1s. per hour for Sundays

and holidays. Though the men may not have worked 60 hours, they were entitled to the 42s. if they were not wilfully absent when required. Not content with these conditions the men struck again in October 1900, and it was then agreed that their pay should be on the basis of the Union rules, viz., 1s. per hour for work done in the ordinary hours, and 1s. 6d. per hour overtime, with a further provision of 1s. 6d. per hour for the following holidays, January 1 and 26, Easter Monday, Queen's Birthday, 8-Hour Day and Prince of Wales' Birthday, and 2s. per hour for Good Friday and Xmas Day.' In this case the company was found to have improperly attempted to break away from the agreed conditions, and an award was made fixing the system and rates as agreed above. But by the end of 1918 wharf-labourers employed by the hour had been awarded minimum rates for ordinary hours of 1s. 9d. and 2s. per hour and in 1922 2s. 9d. per hour—with, in each case, correspondingly higher rates for overtime and for certain cargoes. In the sawmilling industry, for which the first award was made in 1905 by Judge Heydon (one of his first awards), the labourer in a timber-yard, if he was also without experience in the industry, was awarded a minimum wage at the hourly rate of 9d. (6s. per day of 8 hours). By the end of 1917 the wages of these labourers had risen to 10s. 1d. per day, and at the end of 1922 to 82s. by the week. The unskilled worker has thus in 16 to 18 years obtained steady advances in pay up to 100 per cent and more above his pre-arbitration rates; but wages of carpenters and joiners, bricklayers, stonemasons, plumbers and plasterers, engineers, blacksmiths, and other skilled artisans if put together and averaged, would not show between 1904 and the end of 1918 an all-round increase of 50 per cent. They increased at a greater rate between 1918 and 1922.

Shortly after the introduction of the system it became necessary to discover and work upon a standard minimum living wage for the humblest adult male worker, to which other wages would be more or less directly related. The first judgment which provided a definite basis upon which boards in New South Wales worked was that of Mr. Justice Higgins (of the federal court) in the Harvester case, about the end of 1907; he favoured a minimum wage of 7s. per day. In 1908 many New South Wales boards took this result as a starting-point. In 1911 Judge Scholes of the New South Wales court increased this 'basic' wage to 7s. 6d. (*in re* Milk Carters' Award 10, *Industrial Arbitration Report* 639). In 1913 Judge Heydon undertook an exhaustive inquiry into the cost of living, and early in 1914 pronounced in favour of a basic wage of 8s. per day, to be increased by a 'prosperity' allowance of 6d., 9d. or 1s. according to the work. This inquiry was a monumental work, valuable to students of industrial law in New South Wales (14 *Industrial Arbitration Report* 22). During the war the prosperity allowance was recalled, but the basic wage was in New South Wales raised by successive stages to 8s. 9d., 9s. 3d., and 10s.—or £3 per week for adult male workers, and £1 10s. for females; towards the end of 1923 it was fixed at £4 2s. for males and £2 2s. for females. These last orders were made by the board of trade, to which such inquiries are now assigned. The intermediate steps from 1914 to 1918 are detailed in Russell's *Australian Industrial Problems*.

Hours were already in most well-organized callings standardized at 48 before the advent of industrial arbitration (see EIGHT-HOUR SYSTEM). But in many industries longer hours were usual; in particular, ferrymen and delivery carters, very many shop-assistants, and many others worked up to 70 hours, even to 90 where the work was not very strenuous. Now by the action of industrial tribunals, and also by the Eight Hours Act of 1916 (passed for that purpose) a normal week is recognized in all industries as consisting of not more than 48 hours' work. In a few special industries shorter hours are prescribed, and legislation is in hand (1925) to make 44 hours' work a normal week. In reducing the hours of work the Commonwealth court has gone farther than the State court. In very few cases, if any, is overtime forbidden, but the award rates for it are nearly always expensive, and excessive overtime is otherwise prevented by regulation where desirable.

Awards are not good in law if they contravene the express provisions of statutes, but they may deal with the subject matter of an act of parliament in such a way as not to contravene its provisions. Apart from what is here noted, the interpretation of 'industrial matter' is very wide—wide enough, for example, to embrace the awarding of annual holidays, the abolition of night shifts, and the application of the card system in any industry.

Victoria.—The arbitration system in Victoria, while slightly older, is simpler and less developed than that of New South Wales. The most notable difference is that it contains no anti-strike legislation; and strikes in Victoria have been markedly fewer than in New South Wales. If, however, a wages board determination is in force in a trade, it can be suspended for any time up to 12 months.

In Victoria the system is a portion of the factories and shops legislation, and dates from 28 July 1896, when act No. 1445 (Factories and Shops Act 1896) made provision for the creation of special boards to fix the minimum prices or rates which might be paid to persons preparing articles of clothing or furniture or bread making or baking (sec. 15). From these special boards, designed to interfere between employer and employee in certain sweated industries, the Victorian wages board system has been developed. Before 1896 factory and shop legislation in Victoria was of the same character as that of the United Kingdom and of New South Wales.

The development of the system in Victoria has been mainly under the guiding hand of one man, Sir Alexander Peacock, who introduced the first wages boards and administered the law for the greater part of the 20 years following. The process included (1) a succession of amending acts tending to enlarge the system—e.g. act No. 1804 (Factories and Shops Continuance Act 1902) in which the legislature dealt directly with vexed questions that had arisen during the early working of boards, and act No. 1857 (Factories and Shops Act 1903) which created the court of industrial appeals; (2) the development, by judges confronted with new problems, of principles both from the facts of the cases and from the nature of the duties committed to their court—e.g. the judgments of Judge Hood *in re the Bread Board* (13 *Argus Law Reports* 589) upon the principles and evidence on which the minimum wage should be fixed, distinguishing temporary and fluctuating grounds from those which may be regarded as established or permanent, and to the effect that wages which compare favourably with those

awarded in other States should not be increased, and *in re the Starch Board* (ibid. 558) upon dealing with each trade on its own facts and upon the existence and effect of competition among employers.

The present law of Victoria on the subject is found in the Consolidated Factories and Shops Act of 1915, No. 2650. Part VII deals with the appointing of boards, part VIII with the court of industrial appeals, part IX with apprentices and improvers; parts X and XI expressly legislate for some topics which in New South Wales, under the heading 'Industrial matters,' are relegated to industrial boards or to the court or industrial registrar as the case may be—e.g. old, slow and infirm workers, and holidays in certain callings. Under this law special boards are continued, or can be created for any process, trade, business or occupation. Half the members of each board represent employers, half employees, and the whole body nominates its chairman. In default of nomination the appointment is made by the governor in council on the recommendation of the minister. Each board consists of not less than four, nor more than ten, members and the chairman. The appointments are for three years. These boards determine the minimum rates of pay by piece-work or time (or both), and the hours of work; may prescribe the forms of indenture of apprenticeship, and may vary the hours to be worked and the overtime fixed in other parts of the act. They deal with trades or groups of trades; and 'trade' includes process, trade, business or occupation (sec. 134). A resolution of both houses of parliament is necessary before special boards can be created for industries not already within the system. The boards are less numerous and have on the whole less power than in New South Wales.

The court of industrial appeals is established by section 174. It consists of a president and two others. The president is to be a judge of the supreme court, and is to sit in every court of industrial appeal constituted from time to time. The other members represent each side of the industry from whose special board the appeal has been brought. Besides hearing appeals, the court of industrial appeals can deal with matters referred to it by the minister.

Other States.—South Australia has a system of wages boards of the same kind as Victoria, and since 1912 has had an industrial court authorized to supervise that system, as in New South Wales; it closely resembles the court of industrial arbitration of New South Wales, and the Commonwealth court of conciliation and arbitration. In particular it has the power, possessed by the Commonwealth court, but not by that of New South Wales, of calling a compulsory conference in any industry to avert a strike. The system includes punishment for strikes and lockouts, and as a whole has worked well.

In Queensland wages are regulated by a court, not by wages boards. Anti-strike legislation is provided, forbidding strikes except upon notice, after an interval of 14 days, and after a secret ballot; in the case of public utilities there must also have been a conference held before an industrial judge (Industrial Peace Act of 1912-13). Queensland appears to have been the first country in the world to provide by law for a secret ballot before striking, to be taken by State officials.

Western Australia also has an industrial court without wages boards. Anti-strike legislation is included. See the Industrial Arbitration Act of 1912.

Tasmania has a wages board system, with anti-strike clauses in the act.

See on the general question Judge Higgins's *A New Province of Law and Order*, H. M. Murphy's *Wages and Prices in Australia*, and F. A. A. Russell's *Australian Industrial Problems*. The most important official documents are the *Commonwealth Arbitration Reports*, published annually; the *New South Wales Industrial Arbitration Reports* (annual), and the *New South Wales Industrial Gazette*, published monthly. For Victoria see the *Argus Law Reports* and *Victorian Law Reports* (annual volumes), and for South Australia the *South Australian Industrial Reports*, in 5 vols. up to the end of 1922. F.A.A.R.

Innes, Frederick Maitland (1816-1882), born in Scotland in 1816, migrated to Tasmania in 1833, and after a time became editor of the *Observer*. Elected to the first legislative assembly in 1856, he was treasurer of the Weston-Smith-Weston-Chapman ministries (1857-1862), resigning only to become colonial secretary in the last, with a seat in the council. He subsequently became first chairman of committees and then president of the council (1868-72). Between 1872 and 1876 he was again in office, sometimes as premier and sometimes as treasurer (under Alfred Kennerley), during a very difficult period of the colony's existence; his name is especially connected with considerable additions to the powers of municipalities and similar bodies. In 1880 he was again made president of the council, and died on 11 May 1882.

Innes, Sir Joseph George Long (1834-1896), born at Sydney on 16 October 1834 and educated at the King's School, Parramatta, was in 1851 taken into the survey office and in December of that year transferred to the department of justice and made clerk of petty sessions at Sofala on the Turon, then a populous mining settlement. From 1854 to 1856 he was associate to Chief Justice Stephen; in the latter year he went to England to study law and on 17 November 1859 was called to the bar at Lincoln's Inn. Returning to Sydney, he was in 1863 admitted to the New South Wales bar, and in 1865 accepted a district court judgeship in Queensland; this he held until 1869. In 1872 he entered the legislative assembly of New South Wales as member for Mudgee, on 14 May joined the first Parkes ministry as solicitor-general, in August 1873 resigned his seat, in September was nominated to the council, and on 20 November became attorney-general. In 1874 he accompanied Sir Hercules Robinson to Fiji to negotiate the cession of the islands to Great Britain, and was offered, but refused, the chief-justiceship of the new colony. Leaving office in February 1875, he was appointed chairman of committee of the council; this post he retained until 10 August 1880, when he became minister of justice in Parkes's third ministry. In October 1881 he was appointed to the supreme court of New South Wales, and was still in harness when he died on 28 October 1896. (Kt. Bach., 1875.)

Insects, vernacular name of the class Insecta, of the phylum Arthropoda, invertebrate animals with a segmented body and jointed appendages. About 470,000 species have as yet been described, 37,000 of these being indigenous to Australia; but this number falls far short of the total number known to exist. The class is to be recognized by the division of the body into three parts, head, thorax, and abdomen, and by the

presence of three pairs of legs and usually two pairs of wings, attached to the thorax.

In classifying the Insecta, the most important characters are the structure of the wings and mouth-parts, and the details of the life-history. For the purpose of this article we may conveniently adopt a modification of Handlirsch's recent arrangement, bringing it more into accord with the older systems of Packard and Brauer.

Class Insecta. Sub-class Apterygota (insects which do not possess wings, and which have never at any time in the course of their evolution possessed any).

Order 1. Thysanura (silver-fish, bristle-tails). Abdomen with ten segments; no ventral tube or spring present.

Order 2. Collembola (spring-tails). Abdomen with only six segments at the most, the first carrying a ventral tube beneath it, and the fourth or fifth a spring.

Sub-class Pterygota (insects which either possess wings, or, if not, have once possessed them in the course of evolution).

Division Hemimetabola (insects not possessing a resting-stage, or true pupa).

Order 3. Orthoptera (cockroaches, earwigs, grasshoppers, crickets, mantids, stick- and leaf-insects). Mouth-parts formed for biting (mandibulate). Fore-wings tough and leathery (tegmina); hind-wings delicate and of much greater expanse, with a broad anal fan.

Order 4. Isoptera (white ants, web-spinners). Mouth-parts mandibulate. Wings delicate, placed wide apart, nearly always similar in form and with weak venation.

Order 5. Psocoptera or Copeognatha (psocids). Mouth-parts mandibulate, but with a hard pick or chisel developed from the maxilla. Wings delicate, with very simple venation; the hind-wing smaller than the fore. This and the following order are by some authorities classed together as Corrodentia.

Order 6. Mallophaga (biting-lice). Dorso-ventrally flattened, secondarily wingless parasites upon mammals and birds. Mouth-parts mandibulate.

Order 7. Anoplura (sucking-lice). Dorso-ventrally flattened, secondarily wingless parasites upon mammals. Mouth-parts used for sucking, by development of the hypopharynx into a sucking-tube.

Order 8. Thysanoptera (thrips). Wings delicate, equal, without any clear venation, and with a strong fringe of hairs. Mouth-parts abnormal, secondarily developed from a mandibulate type for sucking and piercing.

Order 9. Hemiptera (bugs, cicadas, hoppers, scale-insects, plant-lice). Wings unequal, the fore-wing narrower and longer than the hind, and of tougher consistency. Mouth-parts formed entirely for sucking.

Order 10. Perlaria (stone-flies). Wings reticulate, unequal, the hind pair with an anal fan. Antennae very long. Mouth-parts mandibulate, or the mandibles much reduced. Larvae aquatic, the tracheal system completely closed, without spiracles.

Order 11. Plectoptera (May-flies). Wings reticulate, the hind pair very small or absent. Antennae very short. Mouth-parts atrophied. Larvae aquatic, with paired lateral gills on abdomen. Winged insect emerges as a sub-imago, from which the imago emerges later on.

Order 12. Odonata (dragonflies, damsel-flies). Wings reticulate, either equal (Zygoptera) or somewhat unequal (Anisoptera). Antennae very short. Mouth-parts mandibulate, the maxillae also hardened in part for biting. Larvae aquatic, with caudal or rectal gills; the labium forming a prehensile mask.

Division Holometabola (insects with a resting stage or true pupa. This stage may be either a *pupa libera*—i.e. one in which the wings are not soldered down—a *pupa obtecta*,—i.e. one with wings and appendages soldered down—a *pupa incompleta* (intermediate between *libera* and *obtecta*), or a *pupa coarctata*, i.e. a *puparium* formed from the hardened larval skin, inside which a true pupa is formed).

Order 13. Coleoptera (beetles). Fore-wings forming a hard convex covering (elytron), useless in flight. Mouth-parts mandibulate. Resting-stage a *pupa libera*; more rarely a *pupa incompleta*.

Order 14. Hymenoptera (ants, bees, wasps, saw-flies, etc.). Wings membranous, unequal, the hind being the smaller; closely linked together by a series of hooks during flight. Mouth-parts mandibulate, but with an elongate tongue developed in the higher forms for sucking nectar. Resting-stage a *pupa libera*, preceded by a sub-pupa, and enclosed in an oval cocoon.

Order 15. Megaloptera (alder-flies, snake-flies). Wings membranous, somewhat unequal, with open reticulation. Mouth-parts mandibulate. Larvae mandibulate, either aquatic (Sialioidea) or terrestrial (Rhapidioidea). Resting-stage a *pupa libera*, lying free in the earth, and active before metamorphosis.

Order 16. Planipennia (lacewings, ant-lions). Wings sub-equal, with or without reticulation, the veins hairy, with their terminations on the wing-margin nearly always split into fine branchlets. Mouth-parts mandibulate. Larvae with suctorial mouth-parts. Resting-stage a *pupa libera*, enclosed in a cocoon spun from the anus.

Order 17. Mecoptera (scorpion-flies). Wings equal, with hairy veins, and fine hairs upon the membrane also in most cases; moderately reticulate, with dichotomic branchings of the veins. Mouth-parts mandibulate, but with the mandibles either spear-like or absent. Larvae a caterpillar, with compound eyes, and generally also pro-legs upon abdominal segments 1-8. Resting-stage a *pupa libera*, lying free in the earth, or in an earth-cell.

Order 18. Trichoptera (caddis-flies). Wings sub-equal or unequal, with dense hairs upon the veins and membrane. Mouth-parts much reduced, only the labrum and the two pairs of palpi being present. Larva aquatic, caterpillar-like, but with no pro-legs except the anal pair; usually living in a case constructed of foreign material. Resting-stage a *pupa libera*, often enclosed in a gelatinous cocoon, and swimming actively before metamorphosis.

Order 19. Lepidoptera (butterflies and moths). Wings densely clothed with scales; either similarly veined (Homoneura), or with the hind-wing reduced in size and venation (Heteroneura). Mouth-parts with the mandibles almost always absent, the maxilla usually developed into a long sucking-tube (haustellum). Larva a caterpillar, nor-

mally with five pairs of abdominal pro-legs. Resting-stage generally a *pupa obtecta.*

Order 20. Diptera (two-winged flies). Hind-wings reduced to minute balancers (halteres). Mouth-parts originally mandibulate, but the mandibles either spear-like or absent; a sucking-apparatus developed from the labium in the form of a proboscis. Larva variable in form, but always without thoracic legs. Resting-stage either a *pupa incompleta* (Orthorrhapha) or a *pupa coarctata* (Cyclorrhapha).

Order 21. Aphaniptera or Siphonaptera (fleas). Laterally flattened, secondarily wingless, active, jumping parasites upon mammals. Mouth-parts developed for piercing and sucking. Larva without thoracic legs. Resting-stage a *pupa libera.*

See Tillyard's *Insects of Australia and New Zealand.* R.J.T.

Institute of Science and Industry. See SCIENCE AND INDUSTRY, COMMONWEALTH INSTITUTE OF.

Ipomaea, a large genus of the family Convolvulaceae, consisting of trailing or twining herbs or shrubs, chiefly tropical or subtropical; a few species are found in temperate countries. The trailer *I. pes-caprae* is coastal in most countries, and in Australia extends from New South Wales to northern Australia. It has bilobed leaves, with stalks exceptionally variable in length, and large showy pinkish flowers. In India a decoction of the leaves is used in cases of rheumatism, and the Fijians roast them for caulking canoes. It is an ornamental plant and a useful sand-binder. *I. palmata,* a blue-flowered trailer, which ranges from New South Wales to Queensland, is the 'Egyptian bindweed.' *I. batatas,* the Sweet Potato of South America, is well adapted for cultivation in southern Australia.

Iridaceae, a family of herbs with tuberous roots or rhizomes, found all over the world and especially plentiful in South Africa. Five genera with 24 species are indigenous to Australia. The endemic genus *Patersonia* consists mainly of tufted herbs with blue (rarely yellow or white) flowers. The flowers are packed in a head and enclosed between two leathery bracts—they open one at a time and last for a short period in sunshine, or a whole day in cool weather; fruit a capsule, with several two-valved cells, which explode with considerable violence when ripe and expel the seeds to a distance. *Libertia,* four species of which are indigenous, extends to New Zealand and South America; *L. paniculata,* a brush gully herb which ranges from Victoria to Queensland, has very showy white flowers.

Irish Exiles. This name has been given to three bodies of Irish political prisoners who were transported to Australia.

The Exiles of 1798. O'Connor Morris in his *History of Ireland* (1898), speaking of the insurrection of 1798, says:—'After a few severe examples had been made, the conspirators who had fallen into the hands of the Irish government were amnestied under not unfair conditions; their lives were spared, but they had to leave the country. They were none of them men of marked powers; but some won honour in foreign lands; two or three gallantly followed Napoleon's eagles; more than one made a name for himself in America.' Many of these men, along with others under legal sentence, were sent out to Australia in 1800 and 1801, and some as late as 1806. Amongst them were Joseph Holt (q.v.), a general of the Irish insurgent army; Henry Fulton (q.v.), a Church of England clergyman; James Meehan (q.v.), afterwards deputy-surveyor-general; Father Harold and Father O'Neil, Roman Catholic priests; William Alcott, an officer of the British army on full pay; Michael Dwyer; and William Davis, one of the makers of rebel pikes.

King, who at first believed them to be 'desperate and diabolic characters,' found after a short experience that the great majority were quiet and orderly; but a good deal of trouble resulted from the fact that, while some of those transported had been legally sentenced, no record of the sentences of others was in existence —they had simply been court-martialled, sent to a military depot during the rebellion, and (as the lord lieutenant of Ireland admitted) 'embarked by the officer commanding there without any trace of such proceeding having been anywhere recorded.' Unfortunately in March 1804 a number of the more ignorant Irish convicts mutinied at Castle Hill, and King's suspicions of the whole mass returned with greater vigour; but when the ringleaders had been sent to Norfolk Island the rest quietened down again, and the 'exiles' were gradually absorbed into the population either as emancipists or (where no legal sentence had been recorded) as free settlers.

Young Ireland Exiles.—After the Irish insurrection of 1848 several of the men associated with it were sentenced to penal servitude, and, with one exception, were sent to Tasmania. The exception was John Mitchel, who was deported to Bermuda, but afterwards rejoined his companions in misfortune. Among those transported were William Smith O'Brien, Thomas Francis Meagher, Terence Bellew MacManus, Patrick O'Donoghue, John Martin and Kevin Izod O'Doherty; the four first mentioned were prisoners for life; O'Doherty's term was 14 years; the same sentence had been incurred by John Mitchel and John Martin, but their legal offence was less serious.

Six years after their transportation an amnesty was extended to the three (O'Brien, Martin, and O'Donoghue) who still remained in Tasmania; the other three had escaped, MacManus in 1851, Meagher in 1852 and Mitchel in 1853. Meagher and Mitchel were said to have broken their parole, but Mitchel's partisans repelled the accusation and boldly contended that he had behaved in no way inconsistent with the code of honour; he had given warning of his intention to fly, and had afforded the local magistrate an opportunity of arresting him. What actually took place was that Mitchel, accompanied by the friend who had planned his escape (P. S. Smyth, afterwards a member of the house of commons), rode up to the police court at Bothwell, handed his ticket of leave to the presiding functionary, announced that he was going to escape, and made off before the magistrate had recovered from his surprise. Sir William Denison, then governor of Tasmania, took a very different view of the matter, declaring that Mitchel had sacrificed all claim to courteous treatment and, if recaptured, would be sent to hard labour. Sir William had held similar views with regard to Meagher and MacManus. The most interesting account of these 'exiles' is the *Jail Journal* written by Mitchel, and published after his escape to America.

The Fenians.—In 1867 Western Australia was the only penal depot left in Australia, and some

60 Fenian prisoners were sent there, including a number of ex-soldiers, the most notable of whom was John Boyle O'Reilly. The Fenian societies in America, naturally full of sympathy for men whom they regarded as martyrs, took measures for the rescue of the deported prisoners. Some of the more reckless spirits talked about making a descent in force on Western Australia, but they did no more than talk. The first prisoner who contrived to break bounds and elude pursuit was John Boyle O'Reilly, who had been apprised of the fact that at a certain time an American whaling vessel would be cruising off the coast, and would receive him on board, provided he was outside Australian waters. He made two attempts to reach her, but she did not appear; then, his friends having persuaded the captain of another whaler to be on the look-out, he reached the vessel safely, and escaped to America, where he achieved distinction as a journalist and man of letters. Six other Fenians escaped later in the same way.

Iron. The existence of deposits of iron ore in Australia was known from almost the earliest days of British settlement. William Kent took specimens of ore to England in 1800, and in 1812 Simeon Lord proposed to open a mine in northern Tasmania. In 1852 ironworks were established near Mittagong, to smelt ores described below; in 1875 works at Lithgow, just west of the Blue Mountains, attempted to smelt local and western district ores; but little actual progress was made until in 1908 an act of the federal parliament provided for the payment of bounties on pig-iron made from Australian ore and bar iron and steel made from Australian pig-iron. The resulting industries in the six States are most conveniently dealt with separately.

In *New South Wales* the first attempt to manufacture pig-iron was made at the Fitzroy ironworks near Mittagong. No complete account of the quantity of pig-iron manufactured is available; in returns published in the annual reports of the department of mines (1876-1886) mention is made of amounts that total 13,313 tons, but these returns are obviously incomplete. The Fitzroy iron deposit is situated 60 miles from Sydney, close to the road running between Sydney and Goulburn. The bright red and yellow oxides upon the surface must have always made it noticeable to travellers, and the neighbouring chalybeate spring would add to the interest. The deposit is composed of an excellent brown ore; coal-seams underlie it, and outcrop in the neighbouring valleys; good limestone can be obtained within 40 miles. It is, therefore, not surprising that the first ironworks should have been erected in this vicinity.

The land on which the ore occurs was applied for in 1848 by John Neale, Samuel Holmes, and William Burton, who formed a syndicate, erected a small blast furnace, and imported skilled workmen from England. The works were opened in 1852 by Sir Charles FitzRoy, then governor. Smelting operations were carried on at intervals during two or three years, but eventually discontinued as unprofitable. In 1859 the works were leased by B. W. Lattin and the brothers Hughes; they built a blast furnace which is still standing, and erected blowing engines. 'Anthracite' coal, obtained from the Nattai valley, and charcoal were used as fuel; but again smelting operations did not proceed satisfactorily, and very little iron was produced. In 1864, however, the works were taken over by Ebenezer Vickery, John Keep, and Simon Zollner; they put a Mr. Hampshire in charge, and under his management considerable progress was made. He introduced the hot blast, erected puddling furnaces and rolling mills, and succeeded in making a quantity of iron. Many castings were sent away from the works, among them cylinders for the Gundagai bridge, and girders for Vickery's Chambers in Pitt-street, Sydney. But the cost of production was £5 17s. 6d. per ton of pig-iron; the works were shut down in April 1866, and mine and works sold in 1870 to John Fraser.

In 1875 the works were taken over by the 'Fitzroy Bessemer Steel and Hæmatite Iron and Coal Company,' and the management was given to David Smith, who brought with him from England smelters and other skilled workmen. He also laid down a tramway between the works and the Nattai valley coal-mines. As before, however, very little iron seems to have been made, and the management in 1876 passed into the hands of David Lawson; he, recognizing the inferior quality of Nattai anthracite, obtained his coal and coke from Bulli and Lithgow, and between February 1876 and March 1877 produced 3242 tons of pig-iron at an average cost of £5 per ton.

At Lithgow the foundation of the blast furnace was laid on 1 January 1874. Smelting operations commenced in October 1875, and were carried on intermittently for several years, about 22,000 tons of pig-iron being produced. The ore was obtained partly from clay bands occurring in the district, and partly from brown and magnetic ores obtained from Newbridge and Blayney. The greater portion of the pig-iron was converted upon the ground into castings, bars, angle iron, and iron rails. The large bed-plate, and the fly-wheel now in use at the works, were both manufactured from iron produced from New South Wales ores. But the operations were not financially successful, so that smelting was discontinued after a few years, and the blast furnace was pulled down. The works were then for a short period carried on co-operatively by a body of workmen, the rolling mills being chiefly employed in re-rolling old iron rails. In 1885 the works were taken on lease by William Sandford, who was vigorously supported by James Rutherford (q.v.) of Bathurst; considerable progress was made, and large quantities of scrap iron were worked up into bars, sheets, etc. A sheet mill, a galvanizing plant, and machines for the manufacture of railway spikes were erected, a Siemens steel furnace was added to the works, and in it steel was manufactured for the first time in the colony.

On 1 January 1908 C. H. Hoskins purchased the Lithgow ironworks as they stood. The plant at that time was antiquated and inefficient, with the exception of a new blast furnace that had recently been installed. At the time of taking over it consisted of a blast furnace with three stoves (making 700 tons per week); one 15-ton and two 4-ton basic New Form Siemens furnaces; one 24-inch mill, reversing by means of clutches (this had never been worked and was quite useless); one 18-inch two-high pull-over mill; one 14-inch muck-bar mill; one 14-inch two-high pull-over bar mill; one small 9-inch three-high guide mill. The main operation was the rolling of wrought-iron piles and puddled bar from eight puddling furnaces. The Hoskins Company, however, decided to concentrate on the production of steel. Ironstone was obtained from Carcoar, and in the first year 3946 tons

of steel ingots were made, as well as over 30,000 tons of pig-iron from 51,206 tons of local ore. The amount varied from year to year, mainly on account of occasional industrial troubles, but in 1908-13 the average annual yield was 3811 tons of steel (despite the fact that in 1912 no steel at all was made), and over 36,000 tons of pig-iron from about 60,000 tons of ore. On 1 January 1909 a system of bounties (12s. per ton of pig-iron or steel made from Australian ores) came into force, and up to the end of 1913 the Lithgow works received £105,849 from this source. In 1914 the rate of bounty was reduced to 8s. per ton, but production nearly doubled; in 1914-7 the average annual production was 22,472 tons of steel, and 62,262 tons of pig-iron from 113,027 tons of ore. Published figures for 1918-22 show a yearly output of 76,003 tons of pig-iron from 138,039 tons of ore.

In connection with the Eskbank ironworks the company operates a colliery at Dapto on the coast and another at Lithgow, as well as two cast-iron pipe manufactories in the precincts of Sydney. It owns many iron properties in New South Wales and Tasmania; hitherto the ore has been obtained from mines at Tallawang near Gulgong (a magnetite containing 60 per cent of iron), Cadia SW. of Orange (a red hematite containing 57 per cent of iron), and Carcoar SW. of Blayney (a similar hematite). High-grade ferro-manganese is also produced from ore obtained at Grenfell near Young. The Lithgow plant now includes 2 blast-furnaces with 8 stoves; 3 basic open-hearth furnaces, with a weekly capacity of 3000 tons in all; a 28-inch blooming and finishing mill with a capacity of 4000 tons of rails or billets per week; and three bar mills (one 18-inch two-high pull-over, one modern 10-inch guide mill, and one 9-inch guide mill).

In 1900 the Broken Hill Proprietary Company (for which see BROKEN HILL) acquired deposits of iron ore, showing 66.68 per cent of metallic iron, at Iron Knob and Iron Monarch on the western side of Spencer Gulf in South Australia. Originally it had been intended to use the ore as flux in the company's Port Pirie smelters; but in 1911 it was decided to exploit the deposits for the manufacture of iron and steel, and in 1915 works were opened at Newcastle—that site being chosen because the Newcastle-Maitland coal was considered the most suitable for use in the furnaces. By the end of August in that year 36,214 tons of pig-iron had been produced; in the following eight months 86,000 tons of steel were made; and up to the end of 1921 the production of steel ingots averaged about 190,000 tons annually. Industrial disturbances then caused the closing down of the works, but in 1923, when they were reopened, 147,115 tons of steel were made in six months. During the war the works furnished rails for South African railways, rails and munition bars for the Imperial war office, rails for the transcontinental railway between Port Augusta and Kalgoorlie, and plates, joists, and bulb angles for vessels built by the Commonwealth in Australia. The plant includes four blast furnaces, nine basic open-hearth furnaces of about 600 tons capacity in all, a 35-inch blooming mill, a 28-inch rail mill, three merchant mills (18-inch, 12-inch and 8-inch), and a continuous rod mill. Several subsidiary industries—e.g. the manufacture of nails, wire, wire-netting, wire ropes, black and galvanized iron sheets—have sprung up round the Newcastle works.

In 1901 J. B. Jaquet, geological surveyor, tabulated the New South Wales deposits as follows:—

District.	Description of ore	Estimated minimum quantity in tons.
Breadalbane (near Goulburn)	brown ore and hematite	700,000
Cadia (near Orange)	specular hematite, magnetite, and carb. ore	39,000,000
Carcoar	hematite and brown ore	3,000,000
Chalybeate spring deposits of Southern district	brown ore	1,510,000
Cowra	magnetic ore	100,000
Goulburn	brown ore	1,022,000
Gulgong	magnetic ore	120,000
Mandurama and Woodstock	brown ore	609,000
Marulan	brown ore and hematite	40,000
Mudgee	brown ore with manganese	150,000
Newbridge, Blayney and Orange	brown ore and magnetic ore	150,000
Queanbeyan	magnetic ore	1,000,000
Rylstone and Cudgegong	brown ore	443,000
Wallerawang and Piper's Flat	brown ore	200,000
Williams and Karuah River	titaniferous magnetic ore	1,973,000
Wingello	aluminous ore	3,000,000
		53,017,000

In *Victoria* a good deal of ore has been located, but very little use made of it. Professor Krause estimates the Lal Lal deposit (near Ballarat) at 750,000 tons of available ore containing 68 per cent to 70 per cent oxide of iron, 16 per cent of silica, and a trace of phosphorus. Deposits of hematite, with which is associated magnetite and specular iron, occur at Nowa Nowa in Gippsland. About 1875 a small experimental blast furnace was erected at Lal Lal, and a small quantity of pig-iron produced. But the lack of accessible coal makes it impossible for the present to smelt the ore cheaply.

In *Tasmania* (where the existence of ore has been known since 1812) the British and Tasmanian Charcoal Iron Company, formed to exploit deposits in the Beaconsfield district, commenced operations in 1876. A sum of £80,000 was expended in erecting works, and several hundred tons of pig-iron were produced, but it contained 5 per cent of chromium and was therefore not adaptable to ordinary uses. Still, in about 10 months from 2000 to 3000 tons of pig-iron were produced, and in 1877 the output was about 250 tons per week, containing from 2 to 10 per cent of Cr_2O_3. This was used by Mel-

Drawn by Patricia Tillyard.

1. *Polyzosteria mitchelli.*
2. *Podacanthus wilkinsoni* (male).
3. *Alectoria superba.*
4. *Stropis maculosa.*
5. *Mastotermes darwiniensis* (male)
6. *Amphigerontia illidgei.*
7. *Psaltoda aurora.*
8. *Eurymela bicolor.*
9. *Desudaba danaë.*
10. *Siphanta acuta.*
11. *Callipappus australis.*
12. *Oncomeris flavicornis.*
13. *Havinthus rufovarius.*
14. *Tasmanophlebia lacustris.*
15. *Eusthenia lacustris.*
16. *Eusthenia violacea.*
17. *Austropetalia patricia* (female)
18. *Diphlebid euphoeoides* (male).
19. *Nososcticta solida* (male).
20. *Chorista australis* (male).
21. *Stenopsychodes montana.*
22. *Macronema pulchripenne.*
23. *Austrosialis ignicollis.*
24. *Psychopsis elegans.*
25. *Porismus strigatus.*
26. *Calomantispa spectabilis.*
27. *Periclystus circuiter.*

28. *Stilbopteryx napoleo.*
29. *Perga dorsalis.*
30. *Cyanopterus rufus.*
31. *Thynnus pulchralis* (male and female).
32. *Zaspilothynnus vernalis* (male and female).
33. *Diamma bicolor* (female).
34. *Ephutomorpha sanguiniceps* (female).
35. *Stilbum splendidum.*
36. *Scolia frontalis.*
37. *Abispa ephippium.*
38. *Eumenes arcuatus.*
39. *Sceliphron laetum.*
40. *Exeirus lateritius.*
41. *Megachile mystacea* (female).
42. *Anthophora bombiformis* (female).

bourne ironfounders for making battery shoes, dies, and other articles requiring hardness and toughness; but there was only a limited local market, and operations were suspended. In 1908 3600 tons of ore were raised at Penguin, west of the Mersey River, but no smelting has been done locally.

The Tasmanian geological survey estimates the State's deposits as follows:—

	Potential tons.
Blythe River	17,000,000
Dial Range and Penguin	700,000
Beaconsfield and Anderson's Ck.	1,300,000
Long Plain	20,000,000
Zeehan	2,900,000
Nelson River	Unknown
Total	41,900,000

The Blythe River deposits seem the most important. An analysis quoted by the government geologist shows that the iron contents vary from 46 to 68.7 per cent, the silica contents from 1.6 to 34.2, and the phosphorus contents from 0.04 to 0.09. The Commonwealth government in 1919 engaged three mining engineers to report on this property, but they reported that the lode-matter as a whole was too siliceous for commercial purposes.

In *Queensland* there are deposits of specular iron, hematite and magnetite in the Cloncurry district; one at Mount Leviathan is about 200 feet high, and a quarter of a mile in diameter at its base. Its geographical position, however, makes it at present absolutely valueless. At Mount Biggenden (west of Maryborough) there are high-grade iron deposits from which bar iron of good quality has been produced by Maryborough ironfounders. The estimated quantity of ore available here is 500,000 tons. The deposits at Iron Island in the Rockhampton district are mined to secure fluxes for use at Mount Morgan.

During the war a royal commission was appointed by the State government to enquire into the possibility of establishing state iron and steel works; it reported that the State should at once erect a furnace having a capacity of, say, 150 tons of iron per day, together with extensive by-product recovery coke-ovens and mine equipment. The initial cost should not exceed £150,000. A thoroughly qualified expert should be appointed general manager of the works, and be empowered to choose the most suitable site; he should further investigate (*a*) the advisableness of establishing state steel manufacturing works, (*b*) the cost of such works, (*c*) the local markets, existing and potential, for their product, and (*d*) the possibility of a market for export beyond the State. A general manager has since been appointed, and a site for the works chosen.

The ironstone deposits of *South Australia* are numerous, but only the Iron Knob and Iron Monarch deposits (owned by the Broken Hill Proprietary Company) have been extensively worked. Originally they supplied flux to the lead-smelters at Port Pirie; they are now utilized to supply iron ore for the works at Newcastle in New South Wales. They are situated on the western shore of Spencer Gulf, and are estimated at 130,000,000 tons. Later exploration in the vicinity has proved two more valuable deposits, the Iron Prince and the Iron Baron.

In 1873 a small charcoal furnace was erected near Mount Jagger, about 11 miles north of Victor Harbour. Ore was obtained from an extensive deposit of magnetic iron ore which caps the summit of the mount. But the workmen employed were not sufficiently skilful, the furnace frequently became blocked, and operations were not successful.

In *Western Australia* the most important deposits are at Koolan and Cockatoo islands in Yampi Sound on the north-western coast, between King Sound and Collier Bay. The main deposit stands out abruptly above high-water level to a height, in places, of 600 feet. It has a length of 300 chains and an average width at base of 110 feet, and is estimated to contain 68,850,000 tons of iron ore, averaging about 65 per cent of iron, 6 per cent of silica, .06 of phosphorus, and a trace of titanium oxide. Another deposit at the northern end of the island is estimated to contain 7,800,000 tons, averaging 66 per cent of iron, 5 of silica, .04 of phosphorus, and .35 of titanium oxide.

On Cockatoo Island there is a deposit of hematite outcropping for a length of 110 chains up to 300 feet in height, about 130 feet in width; the estimated tonnage available above high-water level is 13,850,000 tons, averaging about 68 per cent iron and 2 of silica. Another deposit on the northern end of this island is estimated to contain 7,000,000 tons of ore.

Iron ore deposits are widely distributed in this State between Kimberley and the Leeuwin, notably near Nannine, Lake Moore, and Southern Cross; but their geographical position makes most of them useless for the present.

Ironbarks. See EUCALYPTUS.

Ironwood. See ACACIA, CASUARINACEAE. GEIJERA, NOTELAEA.

Irrigation and Water Conservation.

The area of the Commonwealth is 2,974,581 square miles; of this area 1,697,911 square miles (57 per cent) have an average rainfall of less than 15 inches per annum, and must therefore be classed as arid or semi-arid. Much, however, of the soil in these districts is suited for intense cultivation if water were procurable, its texture being for the most part a sandy loam, occurring either in plains of fairly uniform elevation or in rolling country interspersed with sand-ridges. Local watercourses are few, but at wide intervals the semi-arid districts are intersected by rivers which have their source in mountain ranges nearer the coast; and along the river-banks are areas of rich alluvium very suitable for lucerne-growing. Owing to the great variations in the distribution and intensity of the rainfall the flow of most inland rivers is very irregular; at one time they are in high flood, at another almost dry or completely so. Only the Murray and such of its tributaries as take their rise in the Southern Alps (in the south-eastern corner of Australia) are regularly snow-fed, and even there no mountains are of sufficient altitude to carry perpetual snow. In these circumstances no extensive systems of irrigation can be developed without the construction of large storage dams, which will conserve the flood-waters for use in the dry seasons. To determine the volume of water discharged annually a systematic gauging of the rivers has been carried on for many years, the daily heights being recorded at a number of stations, and observations taken with current-meters; thus the capacity of storage to be provided, and the regulated flow which can be depended on for irrigation, are accurately estimated in advance.

The development of irrigation schemes in Australia was retarded for many years by the opposition of private riparian interests, which were

governed by the common law of Great Britain; private irrigators had not even such security of priority right in using river-water for irrigation purposes as obtained in the western States of America. Consequently (except by Chinese gardeners, who consistently irrigated their small holdings) little interest was taken in the development of irrigation schemes until 1884, when (following on a destructive drought) commissions were appointed by the governments of Victoria and New South Wales to enquire into water conservation and irrigation.

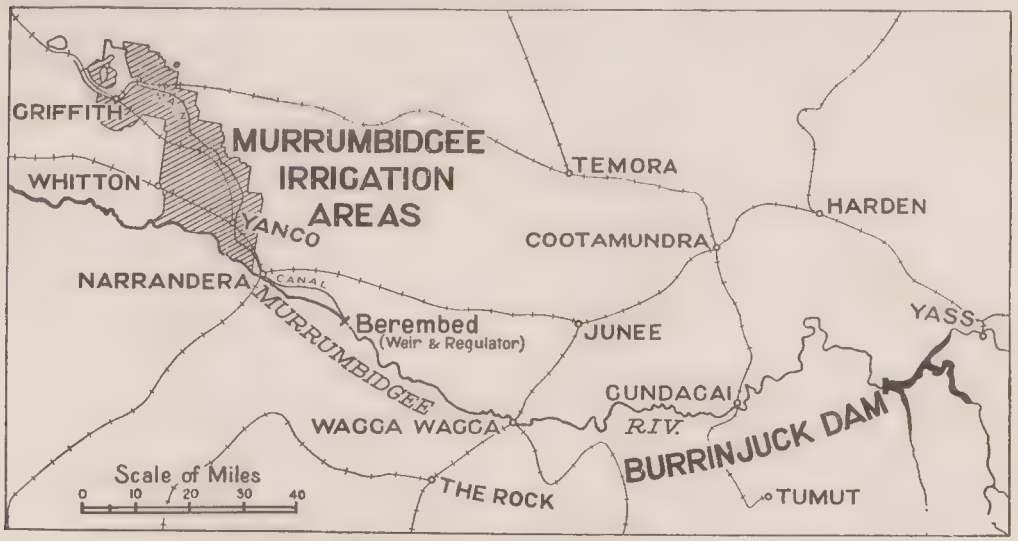
Victoria.—The Victorian commission deputed its chairman, Alfred Deakin (q.v.), who had already investigated irrigation methods in India, to visit the western United States and enquire into the schemes there in operation. His report, submitted in 1885, formed the basis of the Victorian irrigation act of 1886; this vested all riparian rights in the crown, made provision for the declaration of districts most suitable for irrigation and for the construction of headworks of a national character, and made it competent for the government to advance the capital required for local works to trusts formed by settlers in a suitable district. Each trust was empowered to levy such rates upon irrigated land as would cover interest charges at 4½ per cent and a sinking fund of 1½ per cent per annum. In 1887 a beginning was made at Mildura (on the left bank of the Murray, about 16 miles above the Darling junction) in the heart of the mallee country. Two blocks of land of about 25,000 acres each were made available to the brothers Chaffey (q.v.); and they erected the Siki plant which, with its four 6-inch pumps, lifted water from the Murray into a lagoon and thence to the required levels to irrigate 12,000 acres. Irrigation schemes in the Goulburn-Loddon area were developed by trusts. By the end of the century arrangements had been made to intercept the Goulburn by a weir 40 feet in height, and to divert the summer supply into two channels; similar works had been erected on the Campaspe and Loddon rivers and on the south bank of the Murray in this district. Altogether, arrangements for diverting 294,000 cubic feet per minute from the Murray and its tributaries had been completed, either directly by, or with the sanction of, the Victorian government. Owing to the irregularity of the flow, however, the schemes were only partially successful, since preparations had been made to distribute water before it had been conserved. Work on the Waranga reservoir was therefore begun. Before its completion the Victorian government, owing to financial difficulties in which the trusts had become involved, decided to ad-

Irrigation areas, Victoria.

minister directly all irrigation schemes except that at Mildura. By the water act of 1905 (since incorporated in the water act of 1915) a State Rivers and Water Supply Commission was established, and has since pursued a vigorous policy with financial aid from the State government. The most important works under its control are connected with the Goulburn River gravitation scheme, which supplies an area of 870,000 acres in the valleys of the Goulburn, Campaspe, and Loddon either for irrigation or for domestic and stock purposes. The present headwork, a diversion weir on the Goulburn near Nagambie, is constructed of concrete masonry with 21 flood-gates, which raise the upstream water-level 10 feet above the crest. The gates can be lowered in flood-time if necessary to allow of a free discharge of the waters. The weir has a total length (including channel regulators) of 925 feet, and a height of 50 feet. The water is diverted by two main channels, the eastern supplying areas north of the Broken River and the western—which has a capacity of 1700 cubic feet per second—serving to feed distributaries in the Rodney district and to fill Waranga reservoir, the principal storage-basin of the system. This reservoir, which is formed by an earthen embankment 4½ miles long across a natural depression, and covers an area of 22½ square miles to an average depth of 23 feet, has a storage-capacity of 333,400 acre-feet. It feeds two main channels, the Waranga-Rodney with a capacity of 250 cubic feet per second, and the Waranga-Campaspe-Loddon of 1000 cubic feet per second—reduced to 200 at its present termination, which is being extended to the west bank of the Loddon. The total length of distributary channels is 1650 miles. A second reservoir with a storage-capacity of 300,000 feet is being constructed at the junction of the Goulburn and Delatite rivers known as the Eildon or Sugarloaf site. There are smaller diversion and storage works on the Loddon, Werribee, Macallister, and Wimmera rivers, and gravitation and pumping schemes are in operation on the south bank of the Murray. Of the latter the most recent is that at Redcliffs, near Mildura, where an area of about 15,000 acres is being developed for the settlement of returned soldiers.

During 1923-24 the total area irrigated in Victoria was 324,558 acres, of which 94,479 acres were under lucerne 96,887 acres were irrigated for cereals and annual fodder crops, and 64,647 for vineyards, orchards and gardens, the balance for pastures, miscellaneous and fallow. In addition to the land irrigated there are large areas in the north-west (principally in the Wimmera and Mallee districts) which are supplied for domestic purposes and for stock use with water brought over long distances to fill settlers' excavated tanks. The total area of country lands within the State which were artificially supplied with water for this purpose during 1923-24 was 13,955,000 acres.

The royal commission appointed in 1884 by the government of *New South Wales* sat until 1887, and issued three reports. Little, however was done apart from constituting the municipal councils of Wentworth (1890), Hay (1892), and Balranald (1893) into irrigation trusts for the erection of pumping plants and the construction of distributary channels within their districts. In 1896 the colony took over all riparian rights, provision being made for the issue of licences to private irrigators. In the following year a distinguished Indian officer visited the colony on the invitation of the government to report on proposals for irrigation works, and selected the Murray and Murrumbidgee as the rivers on which irrigation projects were likely to prove most successful. A water and drainage act of 1902 provided *inter alia* for the expenditure of £1,000,000 within the next five years on the construction of hydraulic works, and an act of 1906 empowered the government to begin work on the Murrumbidgee scheme. This includes a concrete dam across the Murrumbidgee River at Burrinjuck with a maximum depth of storage of 200 feet and a capacity of 771,641 acre-feet; and a movable diversion weir across the Murrumbidgee at Berembed, 40 miles upstream from Narrandera, including a lock, sluiceway and 55 chanoine wickets, which can be lowered to pass freshets. The main canal with a capacity of 2000 cubic feet per second, takes off from the river immediately above the weir, and extends for a distance of over 90 miles to beyond the township of Griffith. There are numerous sub-



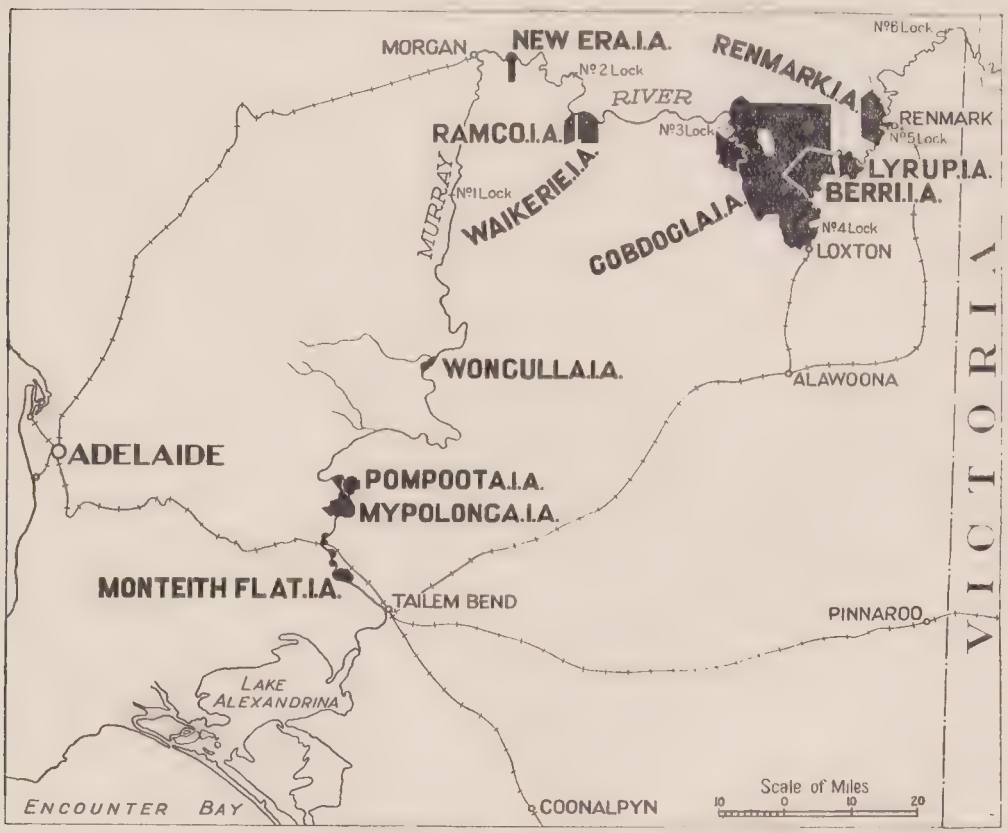
Murrumbidgee Irrigation Scheme.

sidiary canals for serving the irrigated areas, together with bridges and other structures, roadways to each farm, and a general surface drainage system. Butter, bacon and canning factories have been provided for treating the products of the areas, which are chiefly used for the growth of fruit and for dairying.

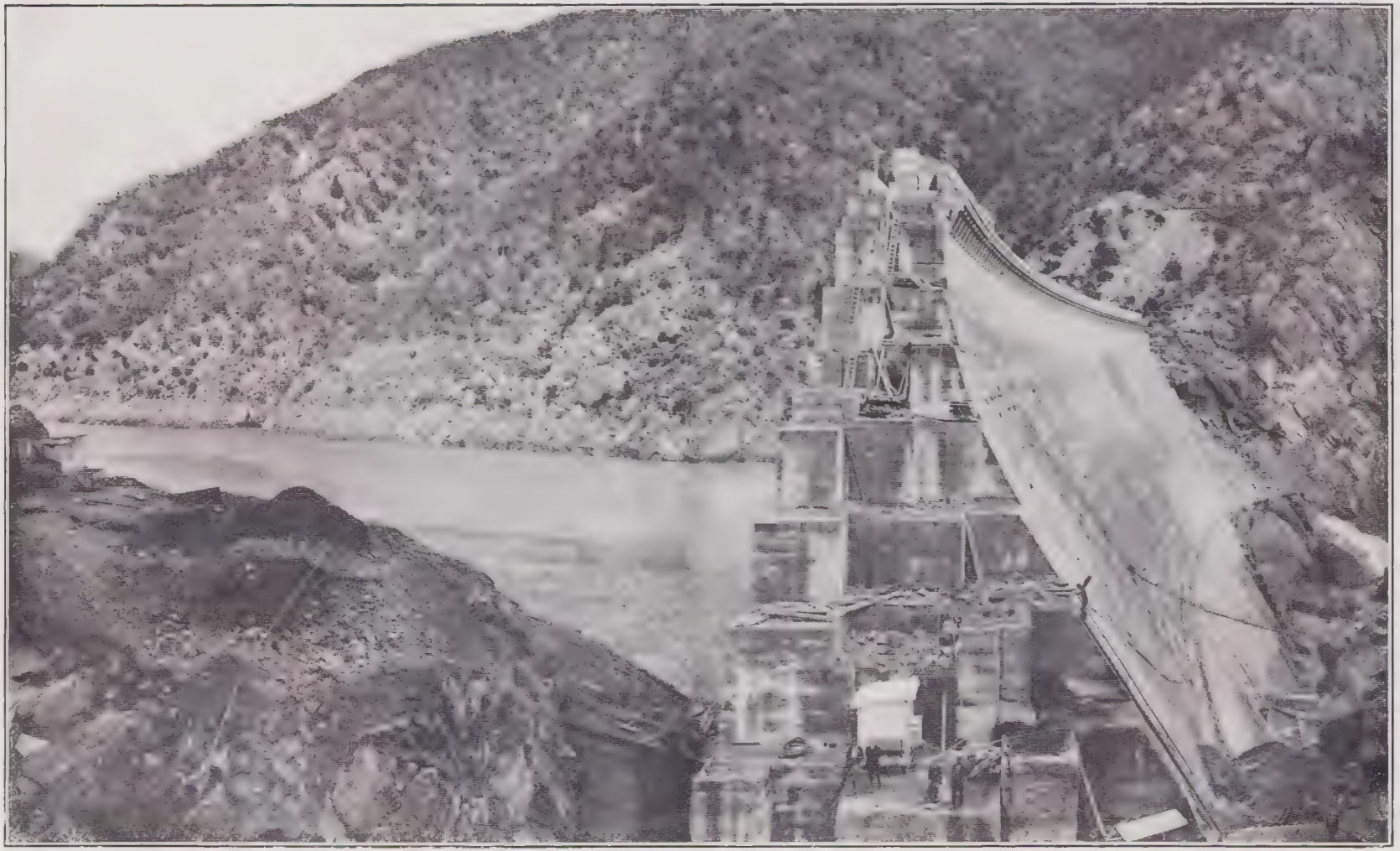
At the beginning of 1913 water conservation and irrigation works within the State were placed under a commission which controls, in addition to the Murrumbidgee scheme, small irrigation areas at Curlwaa, near Wentworth, and Hay, served by pumping from the Murray and Murrumbidgee rivers respectively. The Curlwaa machinery consists of a suction-gas plant, the combined capacity of the pumps being 12,500 gallons per minute. During the 1922-3 season 245,000,000 cubic feet of water were supplied. The length of the main channels is about 10 miles. The pumping machinery at Hay is of similar type, the capacity of the pumps being 4000 gallons per minute. During the 1922-3 season 172,906,732 cubic feet of water were pumped with nine pumpings. Work was commenced in 1924 for the development of a much larger area at Coomealla, adjacent to Curlwaa, water for which will be pumped from the Murray River; and investigation is being made of schemes for damming the Lachlan at Wyangala, the Macquarie at Burrendong, and the Hunter, Namoi, and Peel rivers at sites not yet determined, with a view of using the water for irrigation. The commission also controls the issue of licences to private irrigators, of whom a good many use pumped water on small areas for lucerne and other fodder crops, or for pastures and orchards. A 'private irrigation act' passed in 1924 is designed to foster private irrigation considerably, and more head storage works are needed to supply settlers in dry seasons. On 30 June 1924 1846 licences under the water act were current. Some private schemes utilize artesian water for irrigation purposes. At a small experimental farm at Pera bore (about eight miles west of Bourke) dates, olives, and oranges have been grown with great success in addition to fodder crops. Experimental work with artesian water has also been undertaken at Moree. The provisions of the water act which refer to the construction of storage-works for stock purposes by the State, and their subsequent control by trusts representing both the government and the ratepayers, are also administered by the commission.

Under the act trusts have been constituted for the supply of stock-water to some 2,955,000 acres by the construction of channels, weirs and other works, and to about 4½ million acres by artesian-bore drains. Works in connection with the trusts are carried out by the State, and the cost is repayable over a term of years. The administration is vested in trustees, usually three in each case, of whom one is a government officer; the other two are elected by ratepayers. Shallow boring for settlers is carried out by over 30 plants, operated by the commission, in districts covering 110,000 square miles.

In 1887, soon after the establishment of the Mildura settlement, the Chaffeys under an agreement with the government of *South Australia*



Irrigation areas, South Australia.



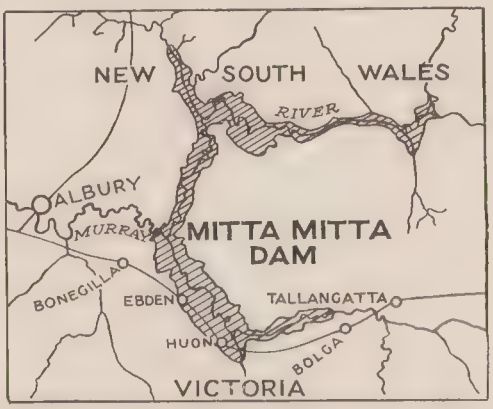
BURRINJUCK DAM UNDER CONSTRUCTION

began to irrigate the Renmark district on the north bank of the Murray 43 miles below the Victorian border. In 1893 the Renmark scheme was put under the control of a trust. There was little further development in irrigation in South Australia until 1910, when an irrigation and reclamation works department was created. Since that date several irrigation works have been constructed along the Murray above Morgan, the plant installed having a pumping capacity of 12,000,000 gallons per hour. Pumping and gravitation schemes have also been put into operation on the Murray below Morgan, the gravitation method being used to irrigate reclaimed swamp-land. These schemes supply an area of 5800 acres. Pumping plants have a total capacity of 5,000,000 gallons per hour.

Queensland possesses no snow-fed rivers, and is dependent on rainfall for irrigation. There is some irrigation from inland streams, but the only extensive schemes so far in operation are in the coastal district, where there is usually a heavy rainfall in the summer months, the rest of the year being dry. The most important works are those on the lower Burdekin River, where the waters both of the river and of the shallow wells along its banks are used. Subsurface water is available in abundance at depths of from 10 to 60 feet, and shallow wells lined with concrete cylinders are sunk to tap it, care being taken to avoid lowering the water-plane; pumping is done by electric power generated at a central station. Irrigation works have also been constructed at Townsville, Rockhampton, Bingera near Bundaberg (where the water is pumped from the Burnett River just above the head of tide-water), and Fairymead (where the water is pumped from a number of shallow spear-wells sunk on alluvial flats north of the Burnett River). In 1922 an area of 14,314 acres was irrigated in the northern State. Under the irrigation act of 1922 a commissioner of irrigation was appointed with wide powers. His chief work has been to develop the most ambitious scheme so far considered by the Queensland government, that for utilizing the waters of the Dawson River. An arched concrete dam, which is projected at Nathan's Gorge, will impound 2,500,000 acre-feet; the submerged area will be 83,177 acres. An area of 5000 acres at Castle Creek, 30 miles downstream, is being prepared for subdivision into farms of 10 to 25 acres each, but it is expected that eventually 200,000 acres will be irrigated for cultivation and as many more for stock and domestic purposes.

In *Western Australia* a number of private irrigation schemes are in operation on the south-western rivers, especially for fruit, fodder, and potato growing. The only works constructed by the government are those at Harvey, which were opened in 1916 to serve an area of 4000 acres. This scheme—which depends for its water supply upon a concrete dam about 40 feet high across the Harvey River, with a storage-capacity of 1600 acre-feet—is being extended.

An extensive scheme providing for conservation on the upper Murray and locking the river below Echuca is under construction; funds are provided by the government of the Commonwealth in association with the States of New South Wales, Victoria, and South Australia. When the Victorian government during the eighties adopted a progressive irrigation policy, South Australia feared that the proposals would affect navigation in the Murray, and in 1887 appointed a commission to investigate the subject. This was later merged into an inter-State commission, and negotiations were begun between New South Wales, Victoria, and South Australia (and later, the Commonwealth) for the conservation and distribution of the waters of the Murray and its tributaries. An agreement reached in 1914 was embodied in a River Murray Waters act, which was passed by the several legislatures and came into force on 31 January 1917. This act provides for the construction of the works by the State authorities under the control of the River Murray Commission, which includes representatives from each State and from the Commonwealth. The commission is responsible also for the gauging of streams and the distribution of waters. Provision has since been made for the construction of (1) the Hume or Mitta Mitta reservoir, and 17 weirs and locks



on the Murray River between Echuca and Wentworth; (2) nine weirs and locks on the Murrumbidgee River; (3) a storage scheme at Lake Victoria, and nine weirs and locks on the Murray below Wentworth. The Hume reservoir, situated above Albury at the junction of the Murray and Mitta Mitta rivers, was originally designed to have a storage-capacity of 1,100,000 acre-feet, but this will probably be increased.

H.H.D.

Irrigation Settlements. Irrigation works are now utilized chiefly for the development of 'closer settlement' policies. In *Victoria* there are 24 irrigation settlements which, with the exception of Mildura, are controlled by the rivers and water supply commission. Mildura is administered by the First Mildura Irrigation Trust, which was constituted in 1895. Holdings under the early settlement schemes varied from 400 to 600 acres, and were too large for intensive cultivation; it was estimated, for example, that only half the water available from the Goulburn works was utilized. About 1909, therefore, a policy of closer settlement on blocks of 12 to 80 acres was adopted, large estates being resumed and subdivided by the government for this purpose. Even after the adoption of this policy progress was slow, owing to the dual control of the closer settlement board and the water supply commission, and to meet this difficulty the management of all land in irrigation areas was in 1912 placed under the commission. Tenure within the settlements is freehold; land is sold to settlers at the valuation at which the estate was purchased while still unirrigated, plus the cost of development and transfer. Payment may be made in instalments extending over a period of 31 years, with interest at 4½ per cent.

The government may make advances to settlers for necessary development work. The settlers are not burdened with the cost of the main construction works, which are financed by the State. The Goulburn-Loddon settlements produce both fodder and fruit crops. In 1921-2 the Shepparton Co-operative Canning Factory produced 214,000 dozen cans of fruit, the supply of fruit increasing at such a rate that other co-operative companies were formed at Ardmona and Tongala to cope with it. Mildura covers an area of 45,000 acres, of which 13,000 were under intense cultivation in 1922-3; the number of water-acres supplied during the year was 42,807. The country, which before the construction of the irrigation works was barren—carrying only one sheep to 30 acres—has proved itself suitable for the growing of vines (especially sultanas), citrus and other fruits. In 1920 the dried fruit harvested from 13,000 acres was valued at £1,238,373 gross.

In *New South Wales* the most important irrigation settlements are those established in connection with the Murrumbidgee scheme in the districts of Yanco and Mirrool. The township of Yanco is Leeton, 12 miles north of Narrandera; Griffith, about 30 miles north-west of Leeton, is the headquarters of Mirrool. The conditions for the disposal of irrigation blocks in these areas are laid down in the crown lands consolidation act of 1913 and the crown land and irrigation (amendment) act of 1914. The tenure is perpetual leasehold; the blocks vary in size from two acres to over 200, the smaller holdings being used for intense cultivation and the larger for dairying. A large area of land in both settlements was reserved for returned soldiers. Each irrigable block carries a certain number of statutory water-rights—a water-right being defined as the right to the amount of water that would cover an area of one acre 12 inches deep. Advances for necessary improvements and for the purchase of stock may be made to settlers by the government on easy terms; the payment by any settler of sums due for rent, water-rates, or improvements effected by the crown may be suspended for any period or periods not exceeding four years, payment to be made in instalments over a period not exceeding 46 years. To provide a local market for settlement products the controlling commission established butter, bacon, vegetable, fruit-canning, and cheese factories in the district; a government experimental farm was opened at Yanco, and nurseries for the propagation of trees and vines to supply settlers' wants were established; sufficient vines are now produced to supply vignerons throughout the State. A power-station has also been erected for the distribution of electric light and power to townships and farms. Despite these advantages the settlements are not yet on a satisfactory financial basis. It is the policy of the government to encourage settlers to take over these industrial plants on a co-operative basis, and in most cases this is already accomplished. Commission control has also been modified by the constitution of an advisory board, on which sit elected representatives of the settlers. On 30 June 1923 2064 farms were held, representing a total area of 119,609 acres; approximately 8036 acres were under deciduous fruit-trees, 5033 under citrus fruits, and 5641 under vines. The number of town blocks held was 839, and the estimated population of the settlements was 12,000. The settlements at Curlwaa and Hay are on a smaller scale. On 30 June 1923 the Curlwaa area covered 10,600 acres, divided into irrigable and non-irrigable holdings; of the irrigable area 1117 acres were planted as orchards or vineyards, of which 868 acres were in full bearing, and there was a small area under lucerne. The estimated weight of dried fruits produced at Curlwaa in 1922-3 was 12,187 cwt., the principal yields being sultanas (3588 cwt.), peaches (2800 cwt.), and currants (2625 cwt.). The Hay irrigation area on 30 June 1923 covered 4500 acres, of which 1035 acres, divided into blocks of from 3 to 34 acres, was used for irrigation. There is not much fruit-growing in the district, dairying being the principal industry. Land in the Curlwaa and Hay areas may be leased for periods not exceeding 30 years. Each lessee is entitled to receive a quantity of water equivalent to a depth of 30 inches per annum over his area, of which not more than four inches may be used in any one month. Since 1913 both areas have been under the control of the water conservation and irrigation commission.

In *South Australia* the principal settlement, that at Renmark, is controlled by a trust constituted in 1893; it covers an area of 30,000 acres, of which 7850 acres are irrigated. The population of the town and settlement is 4800. Fruit-growing is the principal industry. There are two distilleries for the manufacture of grape-spirit, and several packing sheds for dried fruit, the pack of which in 1923 amounted to 2750 tons. The other settlements on the Murray, both above and below Morgan, are administered by the irrigation and reclamation department. Those above Morgan covered, in February 1924, an irrigable area of 17,827 acres allotted to 1068 settlers, 1280 acres being reserved by the department for fodder crops. The soil—for the most part a red, sandy loam—is chiefly suitable for fruit and vine culture. The settlements on the lower Murray comprised 5800 acres of high, irrigable, and reclaimed swamp-land, suitable for fruit and fodder crops. There are 241 settlers in this area. The disposal of land, which is governed by the irrigation and reclaimed lands act of 1914, is on a perpetual leasehold basis, the rentals being fixed by the irrigation commission. The maximum area of irrigable or reclaimed land one person may hold is 50 acres; residence for nine months in the year is compulsory, and certain improvements must be carried out by the settler. Land above the irrigating channels is also offered to lessees of irrigable blocks on a perpetual leasehold basis for dry-farming, grazing, etc. The government is authorized to make advances to settlers for necessary improvements on easy terms.

In *Queensland* and *Western Australia* irrigation settlements are on a small scale. W.S.C.

Irvine, Sir William Hill, nephew of John Mitchel who founded the *United Irishman,* was born at Newry in Ireland on 6 July 1858 and educated at Trinity College, Dublin (B.A., 1879; LL.D., 1904), and in 1879 migrated to Victoria to teach at Geelong College, at the same time studying at the university of Melbourne (M.A., 1882; LL.M., 1886). In 1884 he was called to the Victorian bar, and in 1894 entered politics as representative of Lowan in the assembly; this seat he held till 1906, when he left State for federal politics. When McLean defeated George Turner in 1899, Irvine joined his ministry as attorney-general (to 19 November 1900), and in 1902 on the defeat of Alexander Peacock formed a ministry of many internal changes in which he combined with the

premiership first the post of attorney-general (10 June 1902 to 20 July 1903), then that of solicitor-general (6 February to 18 August 1903), and then that of treasurer (21 July 1903 to 18 February 1904). His most forceful colleague was Thomas Bent (q.v.), with whose aid he succeeded in quelling a dangerous railway strike in 1902-3; in doing so he discovered that civil servants could exercise great pressure on their representatives in parliament, and as a temporary remedy he carried an act disfranchising the public service as far as the ordinary constituencies were concerned, and giving it members of its own. Early in 1904, weary of partisan politics and at variance with many supporters on the land question, he gave place to Bent and became a private member. In 1906 he entered the federal lower house as member for Flinders, which seat he held until he left politics altogether. In this house he kept aloof from the principal parties, being regarded as an independent critic and the spokesman rather than the leader of a cross-bench section. In 1913, however, when Joseph Cook succeeded the Labour leader Andrew Fisher with a bare majority behnid him, Irvine accepted the attorney-generalship, mainly in order to shape and carry certain constitutional amendments; but the war, and the defeat of Cook at the polls in 1914, prevented any move in this direction, and Irvine resumed his independence. On 5 April 1918 he left politics to become lieutenant-governor and chief justice of Victoria. (K.C.M.G., 1914.)

Irwin, FREDERICK CHIDLEY, joined the army in 1808 (ensign, 1808; lieutenant, 1809; major, 1836; lieutenant-colonel, 1845), but nothing is known of his career until in 1829 he was sent to Western Australia in command of a detachment of the 63rd regiment, which had been allotted for the protection of the newly established Swan River settlement. In 1831 he became senior member of the legislative council, and from September 1832 to September 1833 administered the government during the absence of Captain Stirling. He then returned to England and in 1835 published what was probably the earliest account of the colony—*The State and Position of Western Australia*; he also took an important part in the foundation of the Western Australian Association. In 1836 he was sent back to Western Australia with the rank of major to command the local garrison, and from February 1847 to August 1848 was governor of the colony. The Irwin River was named after him by George Grey. (K.H., 1842.) J.S.B.

Isaacs, ISAAC ALFRED, born in Melbourne on 6 August 1855 and educated at the Beechworth grammar school and at the university of Melbourne (LL.M., 1880), was called to the Victorian bar in 1880. Rapidly successful in his profession (he became Q.C. in 1899), he in the early nineties began to interest himself in politics, and in 1892 was returned to the legislative assembly as representative of the Bogong electorate. He was solicitor-general in the Patterson ministry of 1893-94, and attorney-general in the first (1894-99) and second (1900-1901) Turner ministries; then, leaving State for federal politics, he was elected by Indi (Victoria) to the house of representatives, and soon became prominent among the radical protectionist section of Sir E. Barton's followers. In 1904 the Deakin ministry was ousted in favour of J. C. Watson's Labour ministry, and it was doubtful whether Deakin's followers would coalesce with Watson's or with Reid's, but Isaacs collaborated with Lyne in preventing the eventual coalition with Reid's from becoming complete; Deakin could carry over only 15 followers, and Lyne and Isaacs with eight others shared the opposition benches with Labour. When in June 1905 Deakin withdrew his support from the Reid ministry and in July formed a new one, Isaacs was the obvious candidate for the attorney-generalship, which he held until in October 1906 he was elevated to the high court bench. His career as a judge has been marked by special attention to constitutional questions, on which he adopts an attitude strongly favourable to the extension of the Commonwealth's powers.

Island Snapper. See EMPEROR BREAMS.

Isoëtaceae. See LYCOPODIALES.

Isopogon, a genus of the family Proteaceae, consisting of shrubs with rigid, entire or much-divided leaves, endemic in extra-tropical Australia; most of the species are confined to Western Australia. The flowers are yellow, pink, or lilac, crowded in dense cylindrical formation round a woolly axis; corolla regular, with slender tube—the upper portion falls off entire, the persistent base eventually splitting up into segments from the pressure of the ripening fruit; style slender, more or less dilated and clothed with hairs; fruit a hairy nut, embedded in the cone scales and falling with them.

Isopogon anemonifolia.

Isoptera, an order of insects which includes the so-called 'white ants' (see TERMITES) and the web-spinners (embids). Both these families have two pairs of wings—equal or sub-equal—inserted far apart upon the thorax, and with closely similar venation; in both groups, also, the structure of the mouth-parts is normally mandibulate, and the antennae are of a primitive, many-jointed type. But in other respects the groups exhibit very different specializations, the white ants in their social systems and castes, the web-spinners in the habit which gives them their name. It is not yet settled that they are

really close relatives, and they should be regarded as at least two quite distinct sub-orders, Termitoidea and Embidoidea—the first showing, through the gigantic *Mastotermes*, evidence of original descent from blattoid ancestors of a very primitive type.

Termites are discussed under their own name. Web-spinners are rare in Australia, as elsewhere. Only four species have been described, all being placed in the genus *Oligotoma*. Other species exist in collections. They are active, sensitive insects, not unlike an elongated termite in appearance, but much more alert. They run so quickly that it is almost impossible to hold them on one's hand. They are very sensitive to the state of the atmosphere, and cannot even exist unless the exactly right amount of moisture is present. The web, which is usually found on the ground, under loose rocks, stones, or logs, is spun from glands placed in the enlarged metatarsi of the fore-legs.

Froggatt has discussed the embids in *Proceedings* of the Linnean Society of New South Wales, 1896-7, 1904-5. R.J.T.

J

Jabiru. See IBISES.

Jacana. See WADERS.

Jack, ROBERT LOGAN (1845-1921), born at Irvine in Ayrshire on 15 September 1845 and educated at the university of Edinburgh, was in 1866 appointed assistant geologist on the Scottish geological survey, and in 1877 transferred to Queensland as government geologist, with headquarters at Townsville. In 1879 he commenced a series of expeditions which, originally intended to open up new goldfields, traversed and described geologically a great part of the Cape York Peninsula. The first (1879) penetrated from Cooktown to the Archer River, opening a new route to goldfields on the Coen which had been previously exploited and abandoned. The second (1879-80) traversed the peninsula from the Archer to Cape York, encountering hostile blacks several times on the way. For the following 20 years Jack made both scientific and practical use of his position, helping to develop the mining industry and extend the system of artesian wells; he published pamphlets and books on both subjects, and in conjunction with R. Etheridge brought out in 1892 a *Geology and Palaeontology of Queensland and New Guinea.* Resigning his post in 1899, he led an expedition to Korea and northern China, but was thwarted in 1901 by the outbreak of the Boxer war; this produced another book. *The Back-blocks of China,* published in London in 1904. That year he returned to Australia and settled down as a consulting geologist, being frequently employed by the government of Western Australia to investigate mining and artesian problems. The university of Glasgow for his services to science made him an honorary LL.D. His last achievement was *Northmost Australia,* a very full and studied account of exploration since 1600 in the region north of the tropic of Capricorn. While this book was being published in London, its author died at Sydney on 5 November 1921.

Jackman, WILLIAM, born at Dittisham near Dartmouth in England on 19 December 1821, seems to have spent his early boyhood aboard coasters plying in the Channel, but on 17 August 1835 embarked in the *John Barry* for Sydney. According to his own account (the accuracy of which is discussed below) the vessel reached Port Jackson on 29 November, 102 days out from London—a very short passage for those times—then went off to Port Phillip with passengers, and there made ready for a voyage to Bombay. Jackman promptly deserted, shipped aboard the government brig *Siren,* and on 17 January 1836 went in her to Launceston in company with some troops. After various adventures in Tasmania he on 28 April 1837 shipped at Launceston in the whaler *Carib,* which was wrecked about three months later in Nuyts' Archipelago, towards the eastern end of the Australian Bight. Most of the crew succeeded in reaching the shore on floating wreckage, and in securing food and materials for boat-building from the stranded ship; the castaways divided themselves into parties, some to work at constructing a boat, others to search the beach for shellfish and for debris from the wreck. Jackman, when alone on a part of the shore remote from his comrades, was one day surrounded by blacks, who marched him off to the interior, and there he remained for about 20 months, becoming to all intents a member of the tribe. On 28 March 1839, when the tribe was once more on the coast, the whaler *Camilla* of Hobart luckily put in to wood and water; one of her boats came close enough for Jackman to attract notice, and he succeeded in escaping, ultimately making his way to England via King George's Sound, Canton, and South America. His long account of his life among the blacks was embodied in *The Australian Captive; or, An Authentic Narrative of Fifteen Years in the Life of William Jackman,* edited by I. Chamberlayne and published in London in 1853. Chamberlayne, who was a clergyman at Lyndonville in New York State, U.S.A., refused to endorse the statements in the book, which were made on Jackman's sole authority; on the other hand he believed that Jackman's story was entitled to credit. It is difficult to verify any considerable part of the story; but the first part is certainly incorrect. The *John Barry* did not leave England until 9 September 1835 at earliest, for despatches of that date were sent by her. She did not reach Port Jackson in November; indeed, the despatches sent by her were not acknowledged by Bourke until 10 May 1836. Further, in January 1836 she would not have been allowed to carry passengers from Sydney to Port Phillip, and would not have chosen Port Phillip as a starting-point for Bombay. Again, the *Siren* was not a government brig, but a small trader of 141 tons burthen plying between Sydney and Hobart, and in January 1836 was lying in Port Jackson, which she left on the 21st for Hobart. Many of the details Jackman gives about his adventures in Tasmania are also demonstrably incorrect—e.g. he describes Launceston as in southern Tasmania. Of the *Carib* there is no other record in those years, and she certainly did not sail from any Tasmanian port in 1837. As for Jackman's life among the blacks, his account of it is completely at variance with everything known of Australian aborigines; the weapons, marriage customs, methods of training youths, etc., described by him prove his utter ignorance, and make it impossible to believe a word he says about anything else. His actual knowledge of Australia seems confined to the names of a few Tasmanian settlements and of one official—whom he misdescribes.

Jackson, Sir George. See DUCKETT, SIR GEORGE.

Jacksonia, a genus of the family Leguminosae, endemic in Australia, consisting of shrubs with cylindrical, angular, or winged stems and branches. The leaves in most species are replaced by minute scales; pods oval, flat, or swollen. *J. scoparia* (Dogwood, owing to its offensive odour when burning) is a graceful shrub, or small tree, with many pendulous, greyish-green branches along which the yellow flowers with their silvery calyces are produced in great profusion. In parts of Western Australia it provides a useful fodder, relished by cattle and horses. The timber is dark brown, and takes a good polish, but is rather small for most purposes.

Jacky Winter. See FLYCATCHERS.

James, SIR WALTER HARTWELL, born on 28 March 1863 in Perth, Western Australia, was called to the local bar in 1888, and became K.C. in 1902. In June 1894 he was elected to the legislative assembly as member for East Perth, in 1897-8 was one of the delegates from his colony to the federal convention, and in July 1902 became premier and attorney-general of the State. When his ministry was defeated in August 1904, he took the agent-generalship in London, and held it until 1906. Since that time he has lived in Perth. (Kt. Bach., 1907.)

Jamison, SIR JOHN (1776 1844), son of Thomas Jamison who was surgeon's first mate in H.M.S. *Sirius* and afterwards (1802-9) surgeon-general of the colony, was born in 1776, educated for the medical profession, and appointed surgeon in the navy. While serving in the Baltic in 1807, he was decorated with the order of Gustavus Vasa by Charles XIII of Sweden for his aid during an outbreak of cholera in the Swedish army; hence the title 'Sir,' which was thenceforth given him, was not really valid in British possessions. When his father died on 27 January 1811, he inherited a good deal of property in New South Wales, and migrated to the colony to take it over, reaching Sydney on 28 July 1814. Almost immediately he demanded an additional grant of land, on the ground that his inherited estate at Regentville near Penrith was too small for his stock; Macquarie, though he refused the grant, held him in favour, and took him on the journey to Bathurst over Cox's new road in 1815. In 1817, however, something happened. On 29 March of that year Macquarie included him in a list of citizens 'truly and liberally interested for the public benefit;' on 1 December this description was altered to 'intriguing and discontented.' By 1819 the trouble was over, and Jamison was again one of the 'loyal, intelligent and respectable' inhabitants of the colony. His relations with Brisbane were similarly troubled, the governor at first recommending him for a seat on the council and then withdrawing his recommendation; and in 1826 Darling was strictly forbidden by Bathurst to give him any civil employment, a prohibition repeated by Huskisson in the following year. It was not until 1837 that he became a member of council, the appointment ceasing with the proclamation of a new constitution in 1843; and he died at Regentville on 29 June 1844.

His connection with the public life of the colony was thus intermittent and not very important. It was as an agriculturist and squatter that he did valuable work, which was publicly recognized by the grant in 1829 of the gold medal of the London Society for the Encouragement of Art and Manufacture. He was also a good racing man, founder and president of the Sydney Turf Club (1825-7) and the Australian Racing and Jockey Club (1828 onwards). Jamieson-street in Sydney is named after him, though a wrong spelling has been allowed to creep in. On his estate at Regentville Henry Parkes was a labourer in 1839-40 and Thomas Bent was born in 1838.

Jarrah. See EUCALYPTUS.

Javelin-fish, a tropical fish (*Pomadasys hasta*) plentiful on the northern coast of Australia, and occasionally ranging southwards to the New South Wales border. It attains a length of two feet, and is regarded as a first-rate food-fish. One of the spines of the anal fin is enlarged to form a stout spike, from which the fish takes its popular name. A number of allied species occur in Queensland waters, but little has been recorded of their habits. Sweet-lips (q.v.) are near relatives. A.R.McC.

Jefferis, JAMES (1833-1917), born at Bristol on 4 April 1833, was educated at the university of London (B.A., and LL.B.) and received his theological training at New College, London. His first charge was at Saltaire near Bradford in Yorkshire. Leaving England on account of his health, he arrived in South Australia in 1859, and held services in the temperance hall, North Adelaide. On 15 August 1859 a public meeting held in this hall resolved 'to take measures without delay to secure the erection of the intended Congregational church;' the movement resulted in the erection of the Brougham Place church, which with adjuncts is estimated to have cost from £16,000 to £18,000. Here Jefferis found a sphere adequate to his powers, and would not be drawn away from it, though about two years after its opening he was invited to the pastorate of the Pitt-street church in Sydney. His was a ministry of the robust, positive, progressive type; young men rallied round him in large numbers, and the Young Men's Society which he formed took the leading place among such organizations. For 18 years he held a position of commanding influence in Adelaide, both as preacher and as publicist. He was professor of mathematics and natural science in Union College, an institution founded in 1872 to provide advanced education and theological training, and backed by Baptists, Congregationalists, Presbyterians, and, later, Bible Christians. In 1872 Walter Watson Hughes (q.v.) offered to present the college with £20,000, but at Jefferis's suggestion the money was diverted to assist in the establishment of a university. On the establishment of the university Jefferis was offered a professorial chair (which he refused) and chosen as a member of the senate.

In 1877 he left Adelaide for Sydney to become the pastor of the Pitt-street church, to which he had been called three times. For 13 years Jefferis held a commanding position in Sydney, his influence extending far beyond that city and outside his own denomination. He was an ardent defender of national (as opposed to denominational) education, and through his exertions the income from the clergy and school lands, valued at £2,500,000, granted in the time of George IV, was diverted from religious purposes to public education. In December 1889 Jefferis left Australia for England, where in 1890-94 he held pastorates at New College Chapel in St. John's Wood and at Torquay.

Soon, however, the work in Australia appealed to him again, and in May 1895 he returned to his former sphere in North Adelaide, served faithfully and successfully for six years more, and retired on 6 March 1901. Then followed 16 years of retirement from active ministerial life, but not from the service of his brethren, his denomination or the public weal. He died at Encounter Bay on 25 December 1917.

Among his services to Australia must be mentioned his ardent advocacy of the cause of federation.

F.V.P.

Jelly-fish, the popular name of several genera of Scyphozoa, a class of Coelenterata comprising medusae with endodermal gonads, and with a gullet and vertical partitions in the enteron of the polyp stage (when this exists). The commonest form on our coasts is *Aurelia*, whose convex surface is marked by four conspicuous horseshoe-shaped purple bands. In living specimens of *Aurelia* the umbrella is sharply curved, and its margin is fringed with innumerable tentacles, very short and fine. The uniformity of this fringe is broken by eight notches, each containing a sense organ. The 'handle' of the umbrella (manubrium) is divided into four somewhat short arms, having the mouth in the centre. In its life-history *Aurelia* passes through a complicated series of changes. The fertilized egg develops into a hollow, oval embryo, which settles down and becomes a small polyp with a mouth, stomach, and tentacles; this phase was formerly supposed to be a distinct individual, and was named 'hydra-tube' or 'trumpet polypus.' It is usually not more than one-eighth of an inch in height, and is to be found far out on the rocks. In the course of time the little hydra-tube elongates, and becomes marked by a series of transverse lines, so that it appears like a pile of saucers. A little later the top saucer floats off, turns over, and becomes a little jelly-fish which grows rapidly and becomes an *Aurelia*. The same thing occurs with the lower saucers, so that the single hydra-tube gives rise to a number of large jelly-fishes.

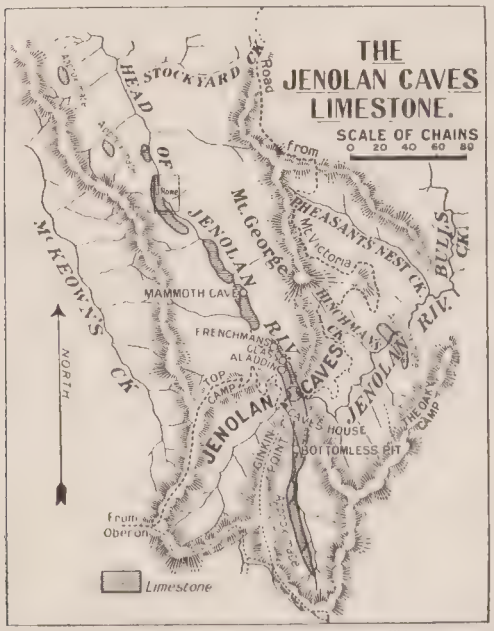
Some of the jelly-fishes in Australian waters are peculiar in having the large lips fused over the mouth, so as to almost obliterate the opening, which is reduced to a number of minute apertures capable of taking in only the tiniest food-particles. These are large, handsome forms; their deep bell may attain a diameter of two feet, and is not provided with marginal tentacles. Another large jelly-fish is *Crambessa*, found in the landlocked harbours along the coast of New South Wales; this form frequently occurs in large numbers (probably brought together by currents and tidal action) but at other times is widely scattered. At all times it forms a very characteristic feature of the life of our coastal inlets. Two colour-varieties of this jelly-fish can be recognized, one blue and transparent, the other deep yellowish-brown and not transparent.

E.A.B.

Jennings, Sir Patrick Alfred (1831-1897), born at Newry in Ireland on 20 March 1831 and educated at the Exeter high school, renounced law for engineering and that for a commercial life, but in 1852 migrated to Victoria, worked on the goldfields, and in 1855 settled at St. Arnaud, where he put up quartz-crushing machinery on a large scale. Prosperity helped him to buy Warbreecan station near Deniliquin in the Riverina district of New South Wales, and he was for a time identified with a proposal to make that district a new colony under the name 'Albertland.' He had long before this attempted to enter politics as representative of a Victorian constituency that stretched from the Pyrenees to the Murray, but got what he afterwards described as 'the most thorough drubbing a young candidate ever received.' In 1867, however, James Martin nominated him to the New South Wales council, and at the end of 1869 he was elected to the assembly as member for the Murray; this seat he resigned on 25 June 1872, hoping but failing to secure election for Mudgee. For the next eight years he lived at home or travelled, representing his colony at the Melbourne exhibition of 1875 and the American Centennial exhibition of 1876. In 1879 he was executive commissioner of the Sydney international exhibition. But he never lost interest in politics; Robertson in 1878 offered him the leadership of the council in a ministry that was never formed, and in November 1880 he came back to the assembly as member for the Bogan. When the Parkes-Robertson coalition broke up at the end of 1882, Jennings joined the Stuart ministry as vice-president of the executive council, but held office for seven months only; for two months at the end of 1885 he was colonial secretary under George Dibbs, and on 26 February 1886 (the intervening time having been filled by a scratch ministry under John Robertson) formed a ministry himself from both sides of the house, whose career was chiefly remarkable for its attempt to introduce a land tax. Its composition was too discordant to allow of long life, and on 19 January 1887 Jennings resigned. Parkes, who succeeded him, sent him to London to represent the colony at the colonial conference of 1887. Never a strong party man, he now dropped out of active politics, though Parkes put him back in the council in 1890, and that body elected him one of its representatives at the federal convention of 1891. Thenceforward he lived in retirement, and died at Brisbane on 11 July 1897.

Outside politics (where his career was troubled, though everyone liked him) Jennings was a cultured and amiable citizen, a member of the university senate, a trustee of the national art gallery, and a zealous patron of music. In 1874 he received from Pius IX the order of St. Gregory the Great. (C.M.G., 1879; K.C.M.G., 1880.)

Jenolan Caves, a series of caves excavated by water in a stratum of Silurian limestone about 500 feet thick that helps to form the core of the main range behind Port Jackson. At a point about 60 miles due west of Sydney this stratum has been exposed by the valleys of two converging streams which, instead of cutting through it as they have through the neighbouring claystones, burrowed into it by dissolving away the lime along natural fissures, and so created (*a*) a series of narrow channels with occasional chambers, (*b*) two large cavernous thoroughfares, one a low tunnel through a superincumbent hill, the other an enormous cavity in which the tower of the Sydney post-office could stand upright. The now insignificant Camp Creek, coming from the south-west, thus in flood-time penetrates the Grand Arch, and below it joins the Jenolan River, a longer stream that has eroded a wider valley and passes in flood-time through the huge cavern known as the Devil's Coach-house. In ordinary seasons both these streams are subterranean, Camp Creek disappearing just above the Arch, Jenolan River a



mile or two above the Coach-house. The caves proper occur in three groups, one (Lucas and River) south of the Arch, a second (Imperial, Elder and Nettle-and-Arch) in the main limestone block between the Arch and the Coach-house, and a third (including Aladdin, Bow and several not yet properly explored) along the sides of the Jenolan River valley.

The problem of the origin of such caves is dealt with under LIMESTONE CAVES. The history of their discovery is, according to the accepted version, as follows. In 1835-8 a convict escapee, McKeown by name (it is also spelt McEwen), used to levy blackmail on settlers in the area round Oberon, killing their stock and holding up their teams—usually by stealing the ox-bows—unless he was bribed off. After many attempts a settler, Charles Whalan, in 1838 managed to track him into the very heart of the main range and along a gully on its eastern side, in which his hut was found and he himself captured in it. His captors, finding themselves in a pleasant and possibly fertile valley, followed the stream down until they entered the huge cavern afterwards called the Coach-house. Other discoveries followed slowly, including those of the Elder (1848) and Lucas (1858) caves—the latter named after John Lucas, who in 1864-9 represented Hartley in the legislative assembly. On 2 October 1866 an area of 6¼ square miles surrounding the caves was made a government reserve; on 8 March 1867 Jeremiah Wilson, a settler from Oberon who had spent a good deal of time in cave-exploration, was made caretaker and chief guide. The reserve now became a tourist resort; but, as it could only be reached through Oberon—which was itself over 140 miles from Sydney and 20 miles from the caves—tourists were scarce, except from the western districts. In 1896, however, the government completed a more direct road from Hartley in the Vale of Clwydd, by which the caves are only 36 miles from the Blue Mountains tourist centre of Mount Victoria (77 miles from Sydney); and this shortening of the distance, coupled with the establishment of a government hotel in the valley above the Arch, at once made Jenolan one of the principal tourist resorts of New South Wales.

The aboriginal name for the caves was Binomea, but for 50 years after their discovery they were known as the 'Fish River' caves, since they had been approached from the valley of the Fish River, which is a tributary of the Macquarie flowing past Oberon. In the tangle of gullies thereabouts it was easy to mistake the direction in which the water of the two creeks flowed; so in course of time men went astray in the lower gully, followed it down in the expectation of coming to settlements on the Fish River, and found themselves after long wanderings in the uninhabited valley of the Cox. It was therefore decided to alter the official name, so that the mistake should not be repeated; and on 10 August 1884 the caves were officially named after the parish of Jenolan, at the northern end of which they are situated.

Jequirity Beans. See ABRUS.

Jersey, EARL OF. Victor Albert George Child Villiers (1845-1915), 7th earl of Jersey, born on 20 March 1845 and educated at Eton and at Balliol College, Oxford, succeeded his father as earl in 1859, in 1875-7 was a lord-in-waiting to Queen Victoria, and in 1889-90 was paymaster-general in the Salisbury ministry. In the latter year, on 26 July, he was gazetted governor of New South Wales in succession to Lord Carrington, during whose term of office the governorship had become a social rather than a political function; and the new governor's sound judgment was of great value to ministers and others during the years which witnessed the first federal convention, the advent of the Labour party to parliament, the great strike at Broken Hill and the beginnings of a severe financial crisis. On 2 March 1893 he resigned office and returned to England, where in 1896-1905 he was chairman of the light railway commission. Though he never again held any office connected with Australia, his interest in the country was permanent and, whenever needed, active; during the first years of the Commonwealth he readily performed many unofficial duties that should have been done by a high commissioner, and his influence with the foreign office was again and again successfully placed at the disposal of the federal authorities. He died on 31 May 1915. (G.C.M.G., 1890; G.C.B., 1900.)

Jervois, SIR WILLIAM FRANCIS DRUMMOND (1821-1897), born at Cowes in the Isle of Wight on 10 September 1821, and educated at the royal military academy, Woolwich, was commissioned 2nd lieutenant in the royal engineers on 19 March 1839 (lieutenant, 1841; captain, 1847; brevet-major, 1854; lieutenant-colonel, 1861; colonel, 1872; major-general, 1877; lieutenant-general 1882). On 26 March 1841 he was ordered to South Africa, where for the next eight years he carried out important engineering and survey work in connection with the defence of the Cape Colony against Kaffirs and Boers, and with the Kaffir war of 1846-8. His survey of British Kaffraria was, 30 years latter, the most accurate available to Lord Chelmsford. Returning to England in 1849, Jervois was from 1852 to 1855 employed on the construction of fortifications in the Channel Islands, and in 1855 was given the command of engineers in the London district; on 7 April 1856 he was attached to the war office as assistant inspector-general of fortifications. The next

year he became secretary to the defence committee, and prepared plans for the defence of London in case of invasion; in 1859, as secretary to a royal commission on the defences of the United Kingdom, he drafted a scheme which was adopted by parliament in 1860 and carried out at an expense of £7,500,000; in 1862 he was put in charge of all British defences as director of works and fortifications, and became the confidential adviser of successive secretaries of state for war. In 1863-5 he visited Canada three times to report on the defences of the British colonies in North America, and to lay out a scheme of defence for their protection; he paid similar visits to Halifax, Bermuda, Gibraltar, and Malta (1869), Aden, Perim, and the chief Indian seaports (1871-2), and, after supervising the completion of his 1859 defence scheme, was in 1875 made governor of the Straits Settlements. Having suppressed a dangerous outbreak in Perak and devised defences for Singapore, he was in April 1877 appointed to advise the Australian governments on the defence of their seaports, taking in October the governorship of South Australia; the comparative leisure of the latter position enabled him to spend a good deal of time in inspecting and planning fortifications for nearly all the important harbours from Adelaide to Brisbane. The scheme on which he worked was designed to provide (*a*) a series of harbours protected with batteries commanding their approaches, (*b*) a small, well-equipped land force to repel landings outside these harbours; but he proposed that raiders should, if possible, be met at some distance from the coast by warships owned by the separate colonies and based on the protected harbours. This proposal was unwelcome at the time, since colonists of those days considered the naval defence of Australia to be purely a matter for the British government; but it initiated discussions that ended in the Tryon agreement of 1886, and heralded a genuinely Australian navy. Transferred in January 1883 to New Zealand (on whose defence he had given advice as far back as 1871), he made his term of office memorable by devising defences for the four chief ports, which were completed before he left the colony, by lecturing on defence subjects up and down both islands, and by persuading the New Zealand government to adopt at once the proposals made by Admiral Tryon (q.v.) for the naval defence of Australasia. In 1885 he saved the colony from a serious entanglement in European complications by tactfully thwarting his ministers' intention to annex the Samoan group. In matters outside defence he did not altogether keep in touch with local feeling; thus, while in South Australia, he did his best to prevent the prohibition of Chinese immigration, advocated unofficially the division of northern Australia into crown colonies admitting Asiatic labour, and looked forward to the government of the Empire by 'an Imperial House of Legislature.' These views, however, he never expressed officially, and his relations with his ministers were invariably amicable. In 1888 he was elected a fellow of the Royal Society. On 18 March 1889 he left New Zealand for England, in 1890 served on a coastal defence committee, and on 28 June 1893 was made a colonel commandant of the royal engineers. A short visit to South Australia in 1892 unfortunately resulted in a severe illness, and thenceforth he lived in retirement, dying on 17 August 1897. (C.B., 1863; K.C.M.G., 1874; G.C.M.G., 1878.)

Jevons, William Stanley (1835-1882), ninth son of Thomas Jevons—a Liverpool iron-merchant who is believed to have constructed the first iron boat that ever floated on sea water—was born in Liverpool on 1 September 1835 and educated at University College school and University College, London (M.A., 1862). In 1853 he was appointed assayer at the Sydney mint, and was engaged in this work from 1854 to early in 1859, devoting his spare time largely to the study of meteorology and climate. His weather reports, published weekly in the *Empire*, were subsequently utilized by the government of New South Wales. Anxious to find a wider sphere of influence, he left Australia in 1859, returned to University College, and studied mathematics and the moral sciences with vigour. His work thenceforth, which had a very wide range (from Shakespeare to Lowe's match tax), had no special connection with Australia; it was mainly concerned with economics, logic, and such allied problems as the probable exhaustion of British coal-supplies, currency investigations, industrial partnerships, the relations between labour and the state, etc. He was, to quote Sir A. W. Ward, 'a statistician of vast industry and rare gifts of combination, and an economist of high original power.' In May 1866 he was appointed professor of logic, political economy, and mental and moral philosophy at Owens College, Manchester; in 1872 he was made F.R.S.; and from 1876 to 1880 he was professor of political economy at University College, London. He was drowned near Hastings on 13 August 1882.

Jewel-fish. See Jewfish.

Jewfish, a name applied to three very different fishes in different parts of Australia. A large marine species, *Sciaena antarctica*, is the jewfish of coastal fishermen in New South Wales; the same fish is called kingfish in the southern States, and in other places butter-fish, dewfish, and mulloway. Its ear-bones (otoliths) are particularly large, and on account of their pearly appearance the species is sometimes called 'jewel-fish;' and the young, because of their brilliance when first captured, are sometimes

Sciaena antarctica

distinguished as 'silver jewfish.' The Australian fish is perhaps not distinct from that known as 'maigre' in European waters. It reaches a length of six feet, and a weight of over 90 pounds, and is an important item in the fish-markets of all Australian capital cities. It sometimes moves in large shoals along the coasts of the southern half of Australia, entering estuaries and inlets, where it is largely captured by net-fishermen. See Teraglin.

The jewfish of Western Australia (*Glaucosoma hebraicum*) is a deep-bodied, perch-like fish, which reaches a length of over 30 inches and is a fine table-fish. It is related to the Pearl Perch (*G. scapulare*) of New South Wales.

One of the catfishes (q.v.) is also commonly known as 'Jewfish.' A.R.McC.

Jews. The first reference to a Jewish element in Australia is that in 1817, when the 20 Jews in *New South Wales* formed themselves into a society for the interment of their dead. Their numbers and resources soon increased, and from 1828 onwards prayers were regularly held at the house of P. J. Cohen in Jamieson-street, Sydney. The first Australian congregation was organized in 1830, for a Jewish population of 345, as the result of a visit by Rabbi Aaron Levy of the London Beth Din (ecclesiastical court), who was despatched to Hobart and Sydney on a special mission by Dr. Solomon Herschell, Chief Rabbi. In 1832 J. B. Montefiore (the first president) and Michael Phillips obtained a grant of land from the government for a burial place, and about the same time a large room in a building in Bridge-street was converted into a synagogue; in the same year the first Jewish marriage in Australasia was celebrated. In 1835 M. E. Rose was engaged in England to become the first Australian Jewish minister. In 1841, the Jewish population having increased to 856 (of whom 500 were resident in Sydney), a site in York-street was purchased for a permanent synagogue, which was opened for divine service on 2 April 1844. One of the founders of the new synagogue, Moses Joseph, became its president. At a later date a second place of worship was opened in a building in Macquarie-street, originally erected as a meeting-house for Quakers. Alexander B. Davis, previously minister at Portsmouth in England and Kingston in Jamaica, became senior minister in Sydney in 1862, and well organized the educational and philanthropic institutions of the young community. The two congregations amalgamated when the present spacious Great Synagogue in Elizabeth-street was consecrated on 4 March 1878. This building, with school premises, cost £27,000. The Jewish population of New South Wales then numbered approximately 3000. In 1903 A. B. Davis retired, and was succeeded by Rabbi Francis L. Cohen, of London, who was installed as chief minister on 25 June 1905, and, being an ordained Rabbi, established a local ecclesiastical court as a branch of the London Beth Din. He has since consecrated three suburban synagogues in Sydney and one at Broken Hill. There is also a small congregation at Newcastle, replacing the older one at Maitland.

The Hebrew Philanthropic Society, which was in 1876 amalgamated with the Orphan Society, and in 1889 with the Sir Moses Montefiore Jewish Home (established in 1887), was first organized in 1833. The institution was in 1923 removed from Dowling-street to Bellevue Hill. The Ladies' Maternity Society, the oldest women's organization in Australia, was founded in 1843, and there are six other Jewish charities in Sydney of long standing. The New South Wales Board of Jewish Education, founded in 1882 and extended in 1906, exercises at a large number of state schools the right of entry and of religious instruction given to all religious bodies by the public instruction act of 1880 (see EDUCATION, PUBLIC). The Maccabean Hall and rooms for the numerous Jewish clubs and young people's movements, forming the New South Wales Jewish war memorial at Darlinghurst, was opened by Lieutenant-general Sir John Monash on Armistice Day, 1923.

In 1842 the first Australian Jewish newspaper was published in Sydney under the title *The Voice of Jacob;* the *Hebrew Standard* (weekly since 1896) and the *Australian Jewish Chronicle* (fortnightly since 1922) are still issued there.

The first attempt to hold regular Jewish services in Victoria then the Port Phillip district of New South Wales, was made in 1839, when small gatherings were held in the home of M. Lazarus. The Jewish Congregational Society was organized in Melbourne in 1841, services being held in the house of Solomon Benjamin. This society developed into the 'Holy Congregation of a Remnant of Israel,' formed in 1844, with A. H. Hart as president. Land for the purpose having been granted by the government, the foundation stone of the first synagogue in Melbourne was laid on 25 August 1847 by the president, Solomon Benjamin. Moses Rintel (q.v.) of Edinburgh, then in Sydney, was appointed minister, and officiated until his death in 1880. In 1853 a new synagogue was built in Bourke-street-west at a cost of £14,000; it was renovated and re-consecrated in August 1877 during the ministry of Dr. Dattner Jacobson. The office of senior minister and president of the ecclesiastical court in Victoria was held from 1884 to 1923 by Rabbi J. Abrahams, Ph.D., who was succeeded by Rabbi I. Brodie. The East Melbourne congregation was founded in 1857, M. Rintel resigning from the Bourke-street synagogue to become minister of the new congregation. The synagogue built in 1859 was replaced in September 1877 by a more suitable building in Albert-street. A suburban synagogue in St. Kilda, which is now the most important Victorian congregation, was consecrated for public worship on 29 September 1872 by A. F. Ornstein and M. Rintel; E. Blaubaum was installed as minister in December 1873, and was succeeded in 1905 by J. Danglow. There are also small congregations at Ballarat and Geelong.

The Philanthropic Society was founded in 1856, and the educational and benevolent activities of the Melbourne community are numerous; prominent among them is the Jewish Aid Society (founded by P. Blashki in 1888) which lends money to struggling traders without any interest, and has an offshoot in Sydney. The *Jewish Herald* (fortnightly) was founded by E. Blaubaum in 1885.

Two years after the colony of *South Australia* was founded, Jacob Montefiore, a pioneer settler, took the lead in congregational affairs; as the number of Jews increased, meetings were held for divine service regularly. In 1848 the present Adelaide Hebrew congregation was founded, Judah Moss Solomon being first president. On 3 September 1850 the synagogue in Rundle-street was consecrated; a grant of land was obtained for a burial ground in 1852; in 1853 the congregation included 38 families and 130 subscribing members. On 26 March 1871 the present synagogue, adjoining the previous one, was consecrated by A. T. Boas, who had assumed his duties in February 1870, and ministered until his death in 1923. The oldest communal institution in Adelaide is the Hebrew Philanthropic Society, which was established on 12 June 1852. The first recorded Jewish marriage celebrated in South Australia took place in 1846.

Although there were Jews in *Queensland* before its separation from New South Wales, their numbers were too small to form a congregation. In the early sixties A. E. Alexander fitted up a room in his premises in Edward-street for regular services. In 1865 Jonas M. Myers arrived in Queensland from Adelaide, and until his death in January 1909 was the mainstay of Queensland Judaism; for many years, when there was no

regular minister, he carried on the duties of the head of the community. In 1867 a cottage in George-street, Brisbane, was fitted up as a synagogue. On 18 July 1886 the present synagogue in Margaret-street was consecrated by A. H. Phillips, assisted by Jonas M. Myers. B. Sinauer was the first president. There is also a small synagogue in South Brisbane, but the congregations in Toowoomba and Rockhampton have ceased to exist.

The Jewish congregation at Perth in *Western Australia* was founded in 1892, and has since rapidly developed. It has a handsome synagogue in Brisbane-street, of which D. I. Freedman has been minister since 1897. The congregation at Coolgardie has ceased to exist.

Sixty-five years ago there was at Hobart in *Tasmania* a considerable Jewish congregation, next to that of Sydney in importance. Its minister, Dr. H. Holzel, was styled 'The presiding Rabbi of the Jews of the Australian colonies.' During the following 30 years the numbers greatly decreased and, except on festivals, the synagogue was closed. Recently, mainly through the instrumentality of S. Benjamin, the congregation was revived. In 1847 a Tasmanian Hebrew Benevolent Institution was formed with H. L. Moses as president. The congregation at Launceston has decayed.

The discovery of gold in the fifties first attracted Jews to Australia in any number; the immigrants were mainly of English nationality, with a few Poles who had lived for some time in England. Subsequent immigration has been of a similar character. A notable feature of the Jewish community in Australasia is the considerable ebb and flow between the States and New Zealand (and to some extent also South Africa), especially of males. The Jewish population of the Commonwealth in 1921 was 21,615, of whom 10,152 were in New South Wales, 7677 in Victoria, 1919 in Western Australia, 1003 in Queensland, 743 in South Australia, and 121 in Tasmania. Members of the pioneer families have taken an eminent part in the development of Australia; among them may be instanced Mr. Justice Isaacs, Mr. Justice Cohen, Judge Cohen, Sir Saul Samuel, Sir Julian Salomons, Sir John Monash, J. B. Montefiore, V. L. Solomon, N. Levi, and G. J. Cohen.

See *The Jewish Year Book, The Jewish Encyclopædia*, and Fowles's *Sydney in 1848*.

Johnson, RICHARD (1757-1827), born at Welton near Hull in Yorkshire in 1757—Bonwick's statement that he was born at Stalham in Norfolk in 1753 is based on a mistaken identification of him with a Richard Johnson who was educated at Magdalen College, Oxford—and educated at the Hull public school and at Magdalene College, Cambridge (Smith scholar, 1780; B.A., 1783), was in 1786 ordained deacon and priest by the archbishop of Canterbury. He had made the acquaintance of William Cowper the poet; and, when the British government decided to make a convict settlement in New South Wales and asked William Wilberforce and John Newton to recommend a suitable chaplain, Cowper suggested Johnson's name to Newton, and on 24 October 1786 he was appointed 'Chaplain to the settlement within Our Territory of New South Wales.' He had already entered on his duties, having visited the hulks at Woolwich two days earlier; and at the beginnnig of December he received from Nepean an order for 'parish necessaries' which included a Bible and prayer-book now preserved in St. Philip's church at Sydney. Johnson sailed in the *Golden Grove*, a store-ship of the First Fleet, which reached Botany Bay on 20 January 1788—a Sunday, so that almost certainly divine service was on that day performed in Australia, though not on land. The transports were brought round to Port Jackson on the 26th—a Saturday—but the beginnings of the landing so occupied the next day that no religious services could be held. Accordingly the first service on land was held on 3 February, Johnson officiating in what is now Macquarie Place under the shade of a large tree. It was a long time before any attempt was made to provide a proper place of worship; for years the services of the Church were performed in the open air, and when the trees were removed services could not be held on wet or boisterous days. The governor and Johnson had for some reason come into collision before they left England; and neither Phillip nor his subordinates made any attempt to provide a place of worship, until Johnson, tired of waiting for the authorities, determined on 10 June 1793 to build a temporary church himself. This was erected close to the present junction of Castlereagh- and Hunter-streets (where a memorial of it was erected in 1925), at a cost of £67 12s. 11½d., which after long delay was refunded to Johnson. He had it finished in time to hold his first service in it on 25 August. Up to Hunter's arrival in 1795 the chaplain was treated with neglect and indifference both by Phillip and by Grose; the latter in particular described him as 'one of the people called Methodists, a very troublesome, discontented character . . . . from whom I have received treatment very unbecoming his character as a clergyman to offer.' Johnson consoled himself with agriculture. He had a grant at Camperdown, and is said to have cultivated with much success a farm and orchard at Ryde, growing fine orange-trees from seeds he had brought from Rio de Janeiro; but the evidence for this Ryde farm is weak. After Hunter's arrival Johnson received more consideration. Hunter describes him as 'a most dutiful son of the Church of England . . . . a Moravian Methodist . . . . I believe him to be a very good, pious, inoffensive man.' In 1794 Samuel Marsden (q.v.) arrived as assistant chaplain and relieved Johnson of a large portion of his duties, which by that time extended to the settlements beyond Parramatta. On 1 October 1798 the temporary church was consumed by fire, in circumstances which pointed to arson, and the convicts were blamed for thus avoiding the enforcement of Hunter's orders that they were all to attend divine service. The governor offered a reward for the conviction of the culprits and, so that they should not gain anything by their crime, had a store-room near the Cove prepared for service by the following Sunday. Johnson seems to have been a sensitive and retiring man, who felt deeply the position in which he was placed, and conscientiously performed his duty under trying circumstances; hard work and lack of sympathy wore him out, and on 12 July 1798 he applied for leave of absence. On 28 September 1800 he left the colony with Hunter in H.M.S. *Buffalo*, arrived in England in the following May and took a two years' rest; asked to resume his duties in New South Wales, he refused, resigned his post, and for some time took the curacy of West Thurcock near Grays in Essex. In 1810 he was appointed to the rectory of St. Antholin in London and in 1817 was inducted into the perpetual curacy of Ingham in Norfolk. Both these livings he held till his death on 13 March 1827. See CHURCH OF ENGLAND.

Johnston, GEORGE (1764-1823), born at Annandale in Dumfriesshire, Scotland, on 19 March 1764, joined the marines on 6 March 1776, when but 13 years of age (2nd lieutenant, 1776; 1st lieutenant, 1778; captain-lieutenant, 1789; major, 1800; lieutenant-colonel, 1808), and saw service in North America (New York and Halifax) and the East Indies, where he was in engagements with the French fleet and on 6 July 1781 was severely wounded. On his return to England in 1785 he obtained leave of absence, and on resuming duty volunteered to accompany the expedition then being sent to New South Wales under Arthur Phillip, as first lieutenant of Ross's company of marines, which sailed in the First Fleet on board the *Lady Penrhyn*. On arrival in Port Jackson he was made aide-de-camp to Phillip, and retained the position under Hunter. By October 1788 he had seen enough of the new land to decide on a longer stay than was allowed to the majority of his fellow officers; and on 10 April 1792 Phillip gave him command of a company of the New South Wales Corps which had been raised from the marines who preferred to stay in the colony. On 12 February 1793 he was granted 100 acres on the main road from Sydney to Parramatta, a block which he named 'Annandale,' and which (with additional land that he acquired in later years) is now the Sydney suburb of that name. There, in 1797, he planted the first Norfolk Island pines brought to Australia.

Hunter in 1796 sent him to relieve King as lieutenant-governor of Norfolk Island, but ill-health soon after his arrival there forced him back to Sydney even before King could leave the island. In 1800, put under arrest by his superior officer William Paterson (q.v.) for giving a sergeant of the corps part of his pay in spirits at an exorbitant price, he accused Paterson of persecution, refused to be tried by court martial in the colony, appealed to the military authorities in England, and was sent to England in the *Buffalo*, in which Hunter returned also. The case is important for three reasons: the authorities refused to try colonial cases in England, and remanded Johnston to Sydney for trial; they then discovered that a properly constituted general court martial could not be had in Sydney, owing to the lack of officers, and so decided to abandon all proceedings; finally, King avowed himself of opinion that there was not an officer in the corps or the colony—except Paterson himself—who had not trafficked in spirits and made a good deal of money by so doing. Johnston returned to Sydney on 16 October 1802.

Early in March 1804 a dangerous mutiny broke out among the convicts employed in the Castle Hill district, and Johnston's gallantry in pursuing and detaining a large body of rebels with a very small force of soldiers and volunteers (30 against 266, according to King), arresting the ringleaders, and dispersing the rest, was highly commended by King in a general order. With Governor Bligh Johnston was from the first on bad terms. He was above all things a soldier, jealous for military discipline and the honour of his corps; several of his misunderstandings with King had been due to this. Bligh was irritable, hasty, foul-mouthed and meddlesome, and in October 1807 Johnston was forced to complain of his abuse and interference with the troops to the commander-in-chief in England. When, therefore, in January 1808 John Macarthur (q.v.) and his military friends called on Johnston to arrest Bligh and assume command of the colony as lieutenant-governor, no motive of friendliness or personal respect for the governor debarred him from drastic action. He was neither the prime mover (Macarthur was that) nor even an actively interested participant; he was a commanding officer whose subordinates had been insulted and accused of treason, and who found himself in a position to right their wrongs and punish their persecutor. Bligh once safely under arrest, Johnston sat back and allowed Macarthur to govern. Superseded in June 1808 by Foveaux (who approved of his conduct towards Bligh but not of his subsequent administration), he persuaded Foveaux's successor Paterson to let him go to England in the *Admiral Gambier* for a full investigation. He sailed on 28 March 1809, was tried in May-June 1811, and returned to the colony as a private citizen on 30 March 1813. What the British authorities thought of his actions is proved by their treatment of him; they tried to drop the whole business, only court-martialled him on his own insistence, punished him merely by cashiering—the mildest possible penalty for such a mutiny—and let him go back to New South Wales. Their treatment of Macarthur, the real head-mutineer, was very different.

The rest of Johnston's life was uneventful. He resided at Annandale, managing his various properties and enjoying Macquarie's friendship, until his death on 3 January 1823. Macquarie, indeed, held so high an opinion of him as to obtain from the British military authorities a decision to restore him to his full rank in the army; unfortunately this decision was not carried out before his death.—His son ROBERT JOHNSTON (1792-1882), born at Sydney on 9 March 1792, was in 1800 entered by Governor Hunter on the books of H.M.S. *Buffalo*, being thus the first Australian-born rating in the navy. He was educated at Newington Butts, near London, under Hunter's guardianship, and served in the squadron that embarked Sir John Moore's army after Coruna, as well as in many minor naval actions of the Peninsular war and in the American war of 1812. In 1823, when he inherited Annandale from his father, he retired from the navy and devoted himself to Australian affairs, but refused to enter politics. He discovered and explored the Clyde River in southern New South Wales, and determined the sources of the Warragamba. He died at Annandale on 8 September 1882—Robert's brother George was appointed to the commissariat department by Macquarie in 1814, and given charge of the military magazines at headquarters; in 1819 he was made superintendent of government stock, but early in 1820 was killed by a fall from his horse. Macquarie greatly lamented his loss, describing him as 'this highly Useful, Meritorious and excellent, worthy Young Man . . . . a Most Useful and Valuable Officer.'

Jollytails, small freshwater fishes (*Galaxias*) rarely attaining a length of eight inches. Their occurrence in the streams of all lands that encircle the Antarctic renders them of special interest to zoologists, and their distribution has been quoted as evidence in support of an argument for the existence of former land-bridges. However, the fact that some species descend to salt water to spawn, and that their young pass the first portion of their lives at sea, largely discountenances the value of such evidence. A number of species are known from streams of the southern half of Australia and Tasmania, but they are so variable in form and colour that the limits of any one are difficult to determine.

They fight their way upstream against the swift currents formed by melting snow, wriggling and swirling in the eddies with a vivacity that has earned them their vernacular name. One species, *G. attenuatus*, is common in the coastal streams of southern and south-eastern Australia, Tasmania, New Zealand, the Falkland Islands, and South America. It migrates to salt water to spawn; in New Zealand the young are captured together with those of an allied fish (*Retropinna*) and marketed as 'whitebait.' A species has been recently discovered in New Caledonia, and others occur in South Africa. In Australia jollytails usually pass under various borrowed vernacular names, such as gudgeon, minnow, mountain trout, lake trout, native trout.

A.R.McC.

Jorgensen, JORGEN (1780-1841), according to his own account, was born at Copenhagen in 1780, locally educated, and at the age of 14 apprenticed to the master of an English collier trading between Newcastle and Copenhagen. When 18 years old he left the collier, and shipped aboard a South Sea whaler that was going to the Cape of Good Hope; at the Cape he transferred into a schooner employed on government service, and in Algoa Bay witnessed an exciting fight between H.M.Ss. *Rattlesnake* and *Camel* and the French frigate *La Préneuse*. Returning to the Cape, he joined the *Lady Nelson*, then on her way under Lieutenant Grant to survey the Australian coasts.

So far his own account has been followed; but here discrepancies are apparent. In the first place, Grant did take a Dane aboard at the Cape, but he was 'a Dane sentenced to transportation.' In the second place, Jorgensen states that the first point the *Lady Nelson* made in Australian waters was King Island—'we sailed round it, and it was named after Capt. King, R.N.' Now the first point the *Lady Nelson* made was Cape Northumberland, and she did not see King Island at all on that voyage. But the *Harbinger*, which was close on her heels, did see King Island (although her first landfall was Cape Otway); also, the *Harbinger* was the schooner in which Jorgensen visited Algoa Bay; and, further, on 24 January 1802 Murray in the log of the *Lady Nelson* mentioned that 'John Johnson'—under which name Jorgensen was at that time borne on the ship's books—identified a rock off King Island, 'having seen it when with Mr. Black, commander of the *Harbinger*.' It seems probable, therefore, that Jorgensen's memory was unreliable, and that he reached Sydney in the *Harbinger*, transferring later to the *Lady Nelson*. That he did serve aboard that vessel is proved by a letter of Macquarie's (30/5/1814), in which he states that Jorgensen served in her under the name of Johnson or Jansen; but the ship's own papers (many of which are lost) have only three possible references to him—Murray's entry above-mentioned, an earlier entry of Murray's (23/11/1801) referring to 'John Johnston, cabin servant,' and an entry in the books of H.M.S. *Buffalo* (to which the *Lady Nelson* was at one time a tender) concerning 'John Johnstone' of Copenhagen, aged 37 in October 1802, who was '2 Mate or Mid' of the tender from 13 December 1802 to 26 April 1804. It is obvious that, if Jorgensen was 37 in 1802, he was born considerably earlier than 1780. His statements, therefore, cannot be too trustfully relied on. He claims, for instance, that in 1801 he accompanied Captain Baudin of the *Géographe* on a journey up the Hawkesbury, and gives details of the visitor's conduct; but we know that Baudin deliberately refused to leave Sydney, and tried to prevent his officers from doing so—it must therefore have been Bailly or Péron, whom King did send on a trip up the Hawkesbury, that Jorgensen mistook for Baudin.

In 1804 he went sealing to New Zealand, and then whaling off the Tasmanian coast; he claims to have struck the first whale killed in the Derwent. In the *Alexander* whaler he visited Norfolk Island, New Zealand (where two Maoris were kidnapped in the Bay of Islands), Tahiti (where also two natives were taken aboard), St. Catharine's Island in southern Brazil, and St. Helena, thence reaching London in June 1806. Jorgensen there handed over the Maoris and Tahitians to Sir Joseph Banks, who did his best for them; but within a year three were dead, and the fourth managed to earn his living as a carpenter.

Jorgensen returned to Copenhagen just in time to see it bombarded by the British fleet under Admiral Gambier. This operation threw Denmark into Napoleon's arms, and Jorgensen commanded a small privateer in the naval war that followed, being captured on 2 March 1808 by the sloop *Sappho* off Flamborough Head. He at once visited Banks as a prisoner of war and was sent off by him on 29 December to Iceland with a cargo of provisions for the inhabitants, who had been reduced to starvation-point by the British blockade. His first trip prospered. On his second, in the *Margaret and Anne*, it was found that the Danish governor, Count Trampe, had forbidden trade with the English; so the owner of the vessel (who had letters of marque from the British government) solemnly deposed the governor and established Jorgensen in his place. Jorgensen administered the island as 'protector' from 20 June to 11 July, establishing trial by jury and a 'free representative government,' halving the taxes, augmenting official salaries, constructing harbour defences, raising a troop of eight cavalry, and hoisting 'the ancient and independent flag of Iceland.' Unfortunately for him, on 11 July H.M.S. *Talbot* anchored in Reykjavik harbour, reinstated Count Trampe, and took Jorgensen back to England to be tried for breaking his parole—which, as he plaintively remarks, he had never given. The commander of the *Talbot*, it appears, was shocked at the idea that a man who had been apprentice in a British collier and midshipman aboard a British surveyship should presume to administer a kingdom.

Jorgensen was imprisoned for a year and paroled at the end of that time, and then led an idle existence in Reading and London, during which he learnt to gamble. In 1812-13 he went again a-voyaging, but ended up in London, found Banks hostile, and fell in with a certain Count Dillon, a French ex-prisoner who was on espionage work, and who imparted to him (as a former prisoner and presumably an enemy of Britain) details of a Franco-American plot to attack the Australian settlements with four French frigates and one from the United States (Jorgensen's memory, playing him false as usual, made him state in after years that two were to be French and two American). He at once reported the plan to the colonial office, but Bathurst refused to believe him, though someone in the office drew up a scheme for intercepting the raiders. As it happened, an American ship, the *Essex*, was already in the Pacific, and captured a number of British vessels; but no French ships joined her, and no attack was

made on New South Wales. Still, the raid of the *Essex* gave some credibility to Jorgensen's report, and for the next few years he was employed by the foreign office as a secret service agent on the continent of Europe; during this period, he says, he was at Waterloo during the battle, and a year or so later met Goethe and Blucher. But the passion for gambling had completely overpowered him, and he sank lower and lower, being condemned in 1820 to seven years' transportation for pawning his landlady's goods. Friends interceded for him, and he was kept at Newgate as hospital assistant, and after a while pardoned; but gambling brought him back to prison with a life sentence, and after three more years in the Newgate hospital he was transported to Tasmania, reaching Hobart on 29 April 1826. There Arthur, who considered him 'a violent political character,' detained him under his own eye as a convict clerk, but afterwards allowed him to enter the service of the Van Diemen's Land Company, and in exploring the country between the Shannon River and Circular Head he had exciting adventures with aborigines, bushrangers and floods. Later he became district constable at Oatlands, and showed resource in dealing with bushrangers and blacks, being for two years in charge of parties organized to protect the settlers. He was one of the few who took an intelligent interest in the aborigines, and collected a vocabulary of their language. His work, which was rewarded with a pardon, helped to pave the way for G. A. Robinson (q.v.). He was given 100 acres of land, but sold it. Cured of the passion for gambling which had been his ruin, he married a woman who bullied him, wasted his money in speculations, and died in poverty and obscurity.

In a copy of the *Hobart Town Almanac* for 1835 with the autograph of Dr. J. D. Hooker (son of Sir William Hooker) Jorgensen's name has been written at the beginning and end of an article entitled 'A Shred of Autobiography,' and the following memorandum is attached:—'J. J. accompanied my father to Iceland in 1809. I saw him in Van Diemen's Land in 1840, a disreputable-looking man . . . . On my return to V. D. L. in 1841 I found that J. J. was dead, his body having been found in a ditch.'

Jorgensen was a prolific writer. Hatchard of Piccadilly published his *State of Christianity in the Island of Otaheite* (1811), and Cadell and Davis his *Travels Through France and Germany* (1817), and he wrote a number of semi-religious tracts on the evil effects of gambling. In Tasmania he published not only the 'Shred of Autobiography' already mentioned—which is the main authority for his life—but a sequel to it in the *Almanac* of 1838, and *Observations on the Funded System* in 1831. His *Rise, Progress and History of the Van Diemen's Land Company*, printed in the Hobart *Colonial Advocate* in 1828, was published as a pamphlet in London in 1829. A great deal of unpublished matter by him is in the British Museum and in the Mitchell Library at Sydney.

See J. F. Hogan's *Convict King* (London, 1891).

W.J.

Judiciary, The. In the Judiciary of Australia three main elements are observable: (1) a complete common-law system of courts in each State, including (at all events in the case of the supreme courts) jurisdiction in equity, bankruptcy, probate, divorce, and admiralty; (2) the high court of Australia, with both original and appellate jurisdictions; (3) many special courts of limited jurisdiction. Matters relating to the personnel, position, tenure of office, and remuneration of judges and magistrates are for the purposes of this article grouped together in a fourth section.

1. The earliest settlers naturally brought the English common law with them, as the test by which crime should be known and civil disputes ended; but the dispensing of law was for a time in the hands of an administration penal and military in character (see CONSTITUTIONS). It took time to build up in this new land complete systems of courts which should dispense the common law, whereby our liberties are better safeguarded than are those of foreigners by the most solemn guarantees of their written constitutions. A brief account only of the process of establishment and the scope of these courts is here attempted.

Charter of Justice.—In 1823 the statute 4 George IV c. 96 authorized the King, by charters or letters patent under the seal of the United Kingdom of Great Britain and Ireland, to erect and establish courts of judicature in New South Wales and Van Diemen's Land respectively, to be styled 'the Supreme Court of New South Wales' and 'the Supreme Court of Van Diemen's Land.' His Majesty by letters patent (known in New South Wales as the Charter of Justice of 13 October 1823) proceeded to 'grant direct ordain and appoint' that there should be 'within that part of our Colony of New South Wales situate in the Island of New Holland a Court which shall be called the Supreme Court of New South Wales to be a Court of Record.' Section 2 of the statute had provided that the said courts 'shall have cognisance of all pleas, civil, criminal or mixed,' and thereby settled their jurisdictions as equivalent in their respective colonies to that in England of the superior courts of the realm held at Westminster. Section 9 had given these supreme courts an equitable jurisdiction of the same character and extent as that of the lord high chancellor of Great Britain in England. In addition, by the combined effect of the act and the charter, an ecclesiastical jurisdiction was conferred upon the court, to deal with wills, probate and the administration of the estates of deceased persons 'as the same is and may now be used in the Diocese of London.' There was also a rudimentary jurisdiction in insolvency. Jurisdiction in matrimonial causes, bankruptcy, and admiralty has since been added; that in admiralty cases was not given until 1911, but before that it was usually (by arrangement) a judge of the supreme court who presided in vice-admiralty. The authority was for New South Wales and Van Diemen's Land more explicitly defined by the temporary act 9 George IV c. 83 s. 3, and made permanent by 5 and 6. Vic. c. 76 s. 53. See also 6 Will. IV. No. 12, setting at rest doubts as to the powers of the court.

In each Australian colony in turn supreme courts were erected, and invested with like authority. This authority includes control by the court of its own officers, and of the legal profession, and of inferior courts by means of appeals and such writs as those of prohibition, mandamus, certiorari and quo warranto. The processes of establishing a supreme court differed in each colony. For Victoria see 13 and 14 Vic. c. 59, which recited it to be 'expedient that the district of Port Phillip, now part of the Colony of New South Wales, should be erected into a separate colony' (sec. 1.). The colony was formed, and a governor and legislative council

provided; the local act 15 Vic. No. 10 made provision for the better administration of justice in the colony of Victoria, and the supreme court was founded thereunder. This provision, however, was insufficient, and the act 18 and 19 Vic. c. 55 (which really gives Victoria its constitution) provided completely in schedule 1 for its supreme court. For Western Australia see 10 Geo. IV c. 22; for South Australia 5 and 6 Vic. c. 61; Queensland was not separated from New South Wales until 1859, by which time a supreme court under a resident judge had been established for the Moreton Bay district. See the Queensland statutes 23 Vic. No. 13 and 31 Vic. No. 23. All the statutes from 9 Geo. IV c. 83 that deal with the constitution of New South Wales (inclusive of Queensland), up to the order in council of 1859 for the erection of Queensland into a separate colony, are collected in vol. i of Pring's *Statutes in Force in Queensland, 1862*. They were consolidated in the Queensland constitution act of 1867.

The statute 4 Geo. IV c. 96, which laid the foundation for the charters of justice of New South Wales and Tasmania, provided also for courts of general or quarter sessions, and authorized the governor of New South Wales to institute courts of request to determine all civil suits under £10 (sec. 20). It provided further for the constitution of a council (the first nominee legislative council) in New South Wales, and the governor with the advice of the council was given power 'to make law for the peace, welfare and good government of the Colony.' Under this authority various local acts were passed for the institution and regulation of courts of general and quarter sessions in New South Wales, and for the establishment of jury panels. By 1834 such courts had been established at Sydney, Parramatta, Windsor, Campbelltown, Maitland, and Bathurst. By separate but similar steps courts of request for the recovery of small debts were established, at first in Sydney and the nearer townships, till in 1839 a local act (3 Vic. No. 6) recited that 'the increase of population in the towns of Melbourne and Port Macquarie respectively makes it expedient and necessary for the interest of the said towns and their neighbourhoods that Courts of Request should be holden in each,' and proceeded to establish them.

Further steps in the completion of our judiciaries are marked by the passing of justices' acts and of district courts or county courts acts. The Victorian county court act and New South Wales district courts act follow fairly closely the provision of the English county courts act. These courts are intermediate between the minor courts and the supreme courts in their respective States; the judges of the district (county) courts are also chairmen of quarter sessions for their respective districts, and thus have both civil and criminal jurisdictions. They also, as in England, act as courts of appeal from justices. Claims as large as £400 may be brought in New South Wales in the district court, but not cases where title of land is *bona fide* in dispute, nor equitable claims. In Victoria a county court may deal with all personal actions where the amount or damages sought to be recovered is not more than £500, and may also exercise a very complete equity jurisdiction in many kinds of suits and matters within the monetary limit.

The justices acts in each State are framed upon the model of those first passed in England at the instance of Sir John Jervis, and give to police or stipendiary magistrates, and to justices of the peace, criminal and quasi-criminal jurisdiction. Their courts deal in a summary way with such criminal matters as may by law be so dealt with, and, where this is not so, can commit prisoners for trial by jury in a higher court. They also deal completely (subject to appeal to quarter sessions) with police offences and many quasi-criminal matters. This jurisdiction of the minor courts on the criminal side is coupled on the civil side with the jurisdiction derived from the early courts of request, now extended in some cases to claims up to £50 in value.

Not all the States are equipped, as are New South Wales and Victoria, with three grades of court. In less populous States there are two grades of court only, the position of the minor courts being somewhat enlarged, though not equal to that of a county or a district court or of a court of quarter sessions. All matters outside their jurisdiction fall naturally in such States into the sphere of the supreme court. In Western Australia a trace of the former crown colony type of government is seen in the style of the 'resident magistrates' who preside in its lower courts.

By these various steps there had been instituted before federation in each colony of Australia a complete judicial system, dispensing the common law of England with amendments made by the general statutory law up to date of devolution, and comprising the equitable and other jurisdictions already mentioned. At the head of the system in each colony with plenary powers (subject, however, to appeal to the privy council) was and is the supreme court of each State.

2. *The High Court.*—Soon after the establishment of the Commonwealth a high court of Australia, contemplated by the judicature provisions in the constitution (sections 71-80), was established. This court has both original and appellate jurisdiction. Its original jurisdiction is derived from the constitution, and by section 75 thereof includes matters arising out of treaties, affecting consuls, for or against the Commonwealth, between States or residents of different States, and cases where writs of prohibition, mandamus or injunction are sought against a Commonwealth officer. Further original jurisdiction has been given to it by the judiciary acts (sections 24 and 30) and by special acts, such as the customs act of 1901 (section 245), the property for public purposes acquisition act of 1901 (section 15) and the Commonwealth electoral act of 1918, part 18.

The appellate jurisdiction of the high court extends to all judgments, orders, etc., (1) of justices of the high court of Australia exercising federal jurisdiction; (2) of any other federal court or court exercising federal jurisdiction; (3) of the supreme courts of States in the exercise of the jurisdictions of their States; (4) of the inter-State commission, as to questions of law only. The high court is thus both a federal court of appeal and a national one. In its appellate capacity it has for the first 20 years of the Commonwealth done its best-known work. Federation did not abolish the right of appeal from the supreme court of a State to the privy council, but gave an option of appeal to the high court, of which the public and profession at once availed themselves. This fact, coupled with the ability of the judges who first constituted the high court (Sir. S. Griffith, Sir E. Barton, and R. E. O'Connor), gave it an immediate ascendency, notwithstanding the power and dignity of the various supreme courts. But al-

though appeal to the high court is most common, a number of appeals are still made to the privy council under the right reserved by the constitution. For litigants in any court of original federal jurisdiction the appeal is to the high court. A litigant in the appellate jurisdiction of the high court can appeal to the privy council only by special leave, obtainable for special cause from the privy council itself; but, if the case involves a question of constitutional power, not even the privy council can grant leave to appeal, unless the high court certifies the case to be one which ought to be determined by His Majesty in Council. To grant such a certificate has not been usual.

The Commonwealth government has not so far found it necessary to establish inferior courts for the exercise of original jurisdiction, utilizing instead the very complete State judiciaries. Thus persons charged with offences against the laws of the Commonwealth are in general (by the judiciary act of 1903, s. 68) triable by State courts, while civil matters (such as appeals from assessment for federal taxes, or assessments of compensation) are deputed to the civil courts of the State in which they arise.

3. In the development of each colony, and of Australia generally, it has been necessary to create special courts which are of themselves no part of the systems already discussed. For example, each colony found it necessary to set up courts to deal with questions relating to crown lands, for the purpose of settling or determining settlers' rights, especially a settler's rights as against the crown. Such courts deal with nothing but crown land matters, and are not necessarily presided over by lawyers. There are, besides, many other courts whose duties are confined purely to the purposes of the creating statute; such are courts of marine enquiry, of review (in taxation matters) and mining courts (held by a mining warden). In many cases these are presided over by a judge or police magistrate. The most important of these special courts are undoubtedly the industrial courts established within recent years by each State, as well as by the Commonwealth, to deal with disputes extending beyond a State (see INDUSTRIAL LAW).

4. Since the creation of the supreme court of New South Wales with Francis Forbes (q.v.) as chief justice, many eminent judges have filled the supreme court benches of the various States. Among them Sir Alfred Stephen, Sir James Martin, and Sir F. M. Darley were chief justices of New South Wales; Sir W. F. Stawell, George Higinbotham, and Sir John Madden filled the same position in Victoria, as did Sir Samuel Way in South Australia and Sir S. Griffith in Queensland.

By the charter of justice the first chief justice of New South Wales was given rank and precedence 'before all other subjects whomsoever within the colony of New South Wales aforesaid,' and the like position has been enjoyed by subsequent chief justices both in this and other States. When the State governor is absent, or the position temporarily vacant, it is usually filled in each State by the chief justice as lieutenant-governor. Salaries range from £3500 (in the case of the chief justice of the high court and of the more important States) down to £600 per annum or thereabouts in the case of magistrates. The positions of judges of the supreme court and of county or district courts are regulated by appropriate acts of parliament. Their tenure of office used to be 'during good conduct'—that is, practically for life or till voluntary retirement. In most cases it is so still, but in New South Wales and Queensland (as in New Zealand) recent statutes have fixed age-limits (70 and 72 years) at which a judge must retire. The stipendiary and police magistrates and other salaried justices are dealt with in the civil service acts of their respective States.

F.A.A.R.

Jujube Tree. See ZIZYPHUS.

K

Kangaroo Paws, the popular name of several species of *Anigozanthos*, a genus of the family Haemodoraceae endemic in Western Australia. The fused calyx and corolla form an elongated tube, recurved at the upper end, with the segments produced into teeth. The flowers thus formed are covered with a woolly coat of plumed hairs, the whole bearing a striking resemblance to the paw of the kangaroo. In *A. rufa* the resemblance is accentuated by the reddish-brown colour of the hairy coat. Other species have green, yellow, or red flowers, or a blend of two or more of these colours.

Kangaroos and Wallabies, a genus (*Macropus*) of diprotodont marsupials abundant in most of the unsettled or sparsely settled areas of Australia (including Tasmania), and represented also in Papua and the Aru Islands. The distinction between kangaroos and wallabies is mainly a mere matter of size; at one time it was proposed to confine the generic name *Macropus* to the larger forms (kangaroos), referring the smaller (wallabies) to a distinct genus, *Halmaturus*. But, apart from size, the differences between the two forms are so slight that the second genus is no longer recognized, and both series are referred to *Macropus*. This, however, does not comprise the rock-wallabies, the nail-tailed wallabies, the hare-wallabies, the Dorcas kangaroos, the tree-kangaroos or the musk-rat kangaroos—all of which are dealt with in separate articles.

All the marsupials above mentioned, together with *Macropus* itself, compose the family Macropodidae. The members of this family are all (except the tree-kangaroos) adapted to living on the ground, predominantly bipedal, and able to progress rapidly by a series of leaping movements in which the fore-limbs, in most cases, take no part. The fore-limbs are smaller than the hind-limbs, and are in all cases provided with five well-developed digits, almost equal in size, and ending in curved and pointed claws. The longer and more powerful hind limbs have usually only four toes; the first toe is undeveloped, the second and third toes are small and (as is universally the case in the diprotodonts) united by a web of skin (syndactylous), the fourth is much the largest and forms the main support for the weight of the body. The fifth toe is comparatively small and weak, like the second and third. The tail is long and powerful, and aids in supporting the body. All the teeth are provided with roots. There are three pairs of incisors in the upper jaw, and one pair in the lower; a small canine may be present in the upper jaw; in both upper and lower jaws there are six grinding or cheek-teeth on each side, of which the last four (the true molars) have the crowns provided either with tubercles or with transverse ridges. Females have a large pouch (*marsupium*), with the opening directed forwards. The food is of a vegetable nature, herbage or leaves for the most part.

The species of *Macropus* are characterized by the comparative length of the hind- as compared with the fore-limbs, the long, pointed ears, and the thick, tapering, evenly-furred tail. The innermost incisor tooth of the upper jaw is only slightly longer than the others; the two lower incisors are nearly horizontal in direction, and are capable—owing to the mobility of the right and left halves of the jaw—of working against one another to a limited extent, like the blades of a pair of shears. The canine is usually very small or absent altogether; the crowns of molar teeth bear transverse ridges (usually two on each connected in the middle by a 'bridge'), and increase in size backwards. In the pouch of the female are four teats.

Of the larger species (kangaroos) there are at least four, all Australian; none occur in Papua.

One is the Great Grey Kangaroo (*Macropus giganteus*), described by Shaw—as *M. major*—in the *Naturalists' Miscellany* for 1790. This is the boomer, or old man kangaroo, found in all parts of the Australian mainland except the centre and the extreme north. It is one of the largest of the kangaroos; owing to its abundance and wide distribution, and to its being commonly represented in European and American zoological gardens, it is probably the best-known member of the tribe, and bulks more largely in scientific and popular literature than any other Australian marsupial. A full-grown male specimen measures about five feet from nose to base of tail; the tail is about three feet long. The fur is short, close and rather woolly, of a grey-brown colour above and almost white underneath.

The great grey kangaroo usually inhabits open eucalypt forest country, such as is typical of the more inland parts of Australia; during the extreme heat of summer, however, it often takes shelter in thicker belts of timber and scrub. It goes about in small parties, which are only casual and unorganized associations without leadership or coherency. Its numbers have become greatly reduced of late years, owing to the advance of settlement, which has subjected it and its allies to wholesale destruction in great 'drives,' in which sometimes many thousands have been slaughtered. This form is represented in Tasmania and Kangaroo Island by a darker variety (*M. fuliginosus*), now almost extinct.

Another widely distributed species is the Great Red Kangaroo (*M. rufus*) which may somewhat exceed the great grey kangaroo in dimensions, and differs from it in the prevailing reddish colour of the fur and the presence of certain black-and-whitish markings on the face;

the females are of a much lighter, bluish-grey colour. The Wallaroo (*M. robustus*) is not so tall as the great grey or the red kangaroos, but is stouter and heavier in the body. Its general colour is a dark smoky-brown, deepening to

Red Kangaroo (*Macropus rufus*).

black at the ends of the limbs and tail; so variable are its colours and character that ten forms have been described, including the variety *isabellinus* from Barrow Island, Western Australia. It inhabits mountainous districts throughout Australia, except in the south-western corner. The remaining large species of *Macropus*, the Antelope Kangaroo (*M. antilopinus*), is confined to the Northern Territory.

Of the larger wallabies belonging to the genus *Macropus*, the most widely spread species is the common Scrub or Black-tailed Wallaby (*M. ualabatus*), which is numerous in various districts in New South Wales and Victoria, and is represented in Queensland by a nearly allied form (*M. ualabatus* var. *apicalis*). The scrub wallaby measures about 33 inches from snout to base of tail, the tail being about 26 inches in length. It has a rather thickset body, with long, thick and rather coarse fur, of a prevailing dark reddish-grey colour, paler below, with black tail and black extremities to the limbs. The Queensland variety usually has the tail tipped with white. Considerably larger than the scrub wallaby is the Red-necked Wallaby (*M. ruficollis*) which occurs in New South Wales and Victoria, and is represented in Tasmania by Bennett's Wallaby (*M. ruficollis* var. *bennetti*), smaller and darker in colour than its near relative of the mainland. The slighter build, the longer ears, and the bright red of the fur at the back of the neck also distinguish it from *M. ualabatus*. Other representatives of the larger wallabies are the Agile Wallaby (*M. agilis*) of Queensland, the Northern Territory, and New Guinea, the Black-striped Wallaby (*M. dorsalis*), which inhabits the inland districts of New South Wales and Queensland, Parry's Wallaby (*M. parryi*), which occurs in the mountains of northern New South Wales and Queensland, and the Black-gloved Wallaby (*M. irma*), a native of Western Australia.

Of the smaller wallabies belonging to the genus *Macropus*, one of the most widely known is the Pademelon (*M. thetidis*), which occurs in Victoria, New South Wales and southern Queensland. The pademelon is a graceful little animal of a total length (including the tail) of about forty inches; it has thick and soft fur, grey on most of the upper surface, reddish on the neck, and nearly white underneath, with brown hands, feet and tail-extremity. It differs from other wallabies in keeping the forepaws wide apart when it leaps, instead of bringing them together. Other small forms are the White-throated Wallaby (*M. parma*), confined to New South Wales; the Red-legged Wallaby (*M. wilcoxi*) of New South Wales and southern Queensland, and the allied *M. stigmaticus* of north-eastern Queensland; the Short-tailed Wallaby (*M. brachyurus*) of south-western Australia; the Dama Wallaby (*M. eugenii*) of south-western and southern Australia and the adjacent islands; the Rufous-bellied Wallaby (*M. billardieri*) of Tasmania and some islands of Bass Strait; and the Toolach Wallaby (*M. greyi*) of southern and south-eastern Australia. See RAT-KANGAROOS. For references see MARSUPIALS.

W.A.H.

Kangaroo Thorn. See ACACIA.

Karri. See EUCALYPTUS.

Kavel, AUGUST, about whose early life nothing is known, was in 1826 appointed minister of the evangelical Lutheran church at Klemzig in eastern Brandenburg, but resigned in 1835 because the Prussian government imposed on the Lutherans a new and (as they contended) heretical liturgy. His congregation, along with many others, being determined not to yield to the government in matters of religion, sent Kavel to London early in 1836 to interview George Fife Angas (q.v.) about arranging for their settlement in the new colony of South Australia. Angas was interested, and did all in his power to promote the migration; but the Prussian government put all sorts of obstacles in the way, and it was not until July 1838 that the first shipload of Prussian and Silesian exiles left Hamburg in the *Prince George*, picking up Kavel at Plymouth and reaching South Australia on 16 November. Other batches followed in the *Bengalee*, *Catherine*, and *Zebra*. During the interval Kavel had worked hard among the Germans in London, and helped Angas greatly in establishing a German mission to the South Australian aborigines. The first settlement in South Australia, made about three miles from North Adelaide, was named Klemzig; there, and afterwards (when German villages grew up along the range) from Angaston to Nairne, Kavel devoted himself to maintaining among his flock a high standard of probity and industry. He died on 11 December 1859.

For a fuller account of the migration see Hodder's *George Fife Angas*, ch. vii.

Kelly, EDWARD (1854-1880), born in 1854 near Wallan in Victoria, was the eldest son of a certain John Kelly who had been transported to Tasmania in 1841 for attempts to shoot his landlord. (Another account gives his crime as killing a man in a faction fight, and the date of his transportation as 1834.) Having served his sentence John Kelly went to Victoria and settled at Wallan, 40 miles from Melbourne, where an easy road through the main range facilitated his stealing horses on the Melbourne side and getting them away through the hills for sale in the Murray valley; but his operations interfered with those of a stronger horse-stealing gang, which one night captured him, his family, and a family of Quinns that worked with him, took them to the top of the range, and bade them go north on pain of death if any of them

were ever discovered on the Melbourne side again. The Kellys and Quinns therefore made their way to the King valley and settled in the hills above Greta, near Glenrowan, resuming their trade of cattle- and horse-stealing with much success. John Kelly died in 1865, leaving a family of seven—Ned, Jim (born in 1856), Dan (born in 1861) and four daughters, of whom Kate is the best-known. All the boys were in trouble from their early youth. Ned in 1870 was arrested as an accomplice of the bushranger Harry Power, but betrayed him and so escaped punishment. Jim in 1871 incurred a five years' sentence for horse-stealing, served it, went to New South Wales, 'stuck up' a number of people there, and got off with a ten years' sentence which kept him safely out of the way while his brothers were becoming notorious. Ned in 1871 was given a three years' sentence for horse-stealing. Dan in 1876 was given three months for aiding a housebreaker; in 1877 six warrants were issued against him for horse-stealing, but he evaded capture.

By 1878 Ned Kelly had formed a gang of thieves, comprising himself, his brother Dan, Steve Hart (a native of Wangaratta born in 1860) and Joe Byrne, born near Beechworth in 1857. In April of that year a constable attempted to arrest Dan at his mother's house, and was shot in the arm by Ned; and on the following day Mrs. Kelly and two neighbours were arrested for attacking the constable, Ned and Dan having concealed themselves in the rough country at the head of the King River. A reward was offered for their apprehension, and for five months the police made an unsuccessful search; but in October when news came that they were in the Wombat hills, parties from Greta and Mansfield set out to surround them, and the gang, coming upon the Mansfield party, shot three policemen. This encounter was decisive. On the one hand the government at once offered £200 for each of them, alive or dead, and increased the reward two days later to £500. On the other hand the bandits, knowing themselves outlawed, began a career of active and desperate crime. The story of the next two years is well known, and may be read in detail in the books named below. It included raids on Euroa (11 December) in Victoria, and Jerilderie (9 February 1879) in New South Wales—at both places the banks were robbed, and Jerilderie was held for three days; after the second raid rewards offered by the governments of Victoria and New South Wales amounted to £8000 in all. Then for 16 months the gang remained quiet. Not all the rewards could induce their friends to betray them, though the police put pressure on those known to favour them, and brought black trackers from Queensland to assist in the search. At last an accomplice named Aaron Sherritt, on the promise that he should receive a clear £4000 of the reward, agreed to lead the police to their hiding-place. On 27 June 1880 he hid a party in his cottage, but Dan Kelly and Byrne had him enticed to the door and shot him; then, knowing that after this outrage a strong force of police would certainly be sent against them, the gang hastened to Glenrowan, where the main railway line crosses a low ridge, took possession of the township, and tore up the rails at the far end of a cutting just where the line runs on to a curved embankment and across a deep ravine. All the male inhabitants of the township, and all strangers who came along, were interned in the local hotel, a few Kelly sympathizers keeping them company.

Meanwhile the authorities in Melbourne had hastily sent off a special train with police and black trackers, which about dusk on the 28th was stopped a little way out of Glenrowan by a schoolmaster who had escaped from the Kellys' custody. Preparations were at once made for an assault on the hotel, and a request for a small cannon was telegraphed back to Melbourne, a 12-pounder Armstrong gun with a detachment of garrison artillery being promptly despatched by train. So exaggerated, indeed, were the official ideas of the gang's strength that it was even proposed to send off an electric search-light to facilitate night attacks. During the evening several of the captives were let go from the hotel, and the affair became a siege; at daybreak reinforcements of police arrived from Wangaratta, the rest of the captives were allowed to leave the hotel, and Ned Kelly—who had got through the police cordon in the darkness and was firing at his assailants from the rear, clad in rough head and body armour—was shot in the legs and captured. In the afternoon of the 29th the hotel building was set on fire, and the bodies of the other three members of the gang were found in the ruins, probably self-slaughtered. The gun-train was therefore held up at Seymour. Ned Kelly was taken to Melbourne, convicted there of the murder of the Mansfield police, and hanged on 11 November. His 'armour,' which was made out of stolen plough mouldboards and weighed nearly 100 lb., is still preserved at police headquarters in Melbourne. A duplicate suit, which was for many years exhibited in the so-called 'convict hulk' *Success*, was made after Kelly's death to be shown in the Melbourne exhibition of 1881. It is on record that the rest of the gang had similar armour, but their suits have disappeared.

The most accurate account of the Kelly gang's doings will be found in Charles White's *History of Australian Bushranging* (1906). Hare's *Last of the Bushrangers* (1892) and Boxall's *History of the Australian Bushrangers* (5th edition, 1924) are also useful.

Kelly, James (1791-1859), born at Parramatta on 24 December 1791, went to sea as a boy and was employed in the whaling and sealing industry. In December 1815 he left Hobart in a whaleboat manned by four men, and circumnavigated Tasmania, discovering Port Davey and Macquarie Harbour; in his narrative of this voyage he gives an account (the only first-hand description available for this early period) of the life of the sealers of Bass Strait and the aboriginal women whom they bought or stole—the ancestors of the so-called half-castes of Bass Strait. In 1817 Kelly was sealing on the New Zealand coast, in command of the schooner *Sophia*, when the Maoris attacked his men at Otago harbour, and killed his brother-in-law William Tucker, who had been the first man to bring to Sydney for sale a dried Maori head (these were in those days sought after by connoisseurs for their tattoo marks). The Maoris then tried to seize the vessel, but the crew (16 against 400, according to Kelly's figures) cleared the deck with their sealing knives. In 1819 Kelly was appointed harbour-master and pilot at the Derwent, became largely interested in whaling, and owned several vessels. In 1832 he took his ship the *Venus* down to 72° S. lat., thus becoming technically the first Australian explorer of Antarctic regions. He died at Hobart on 20 April 1859. His name is preserved in Kelly Basin at the head of Macquarie Harbour.

T.D.

Kemp, ANTHONY FENN (1773-1868), born near Aldgate in London in 1773, and educated at Greenwich, travelled in France and the United States while still a youth, and on 24 July 1793 was commissioned ensign in the New South Wales Corps (lieutenant, 1797; captain, 1801). His early career in the corps was uneventful; in 1795 he took his turn at Norfolk Island, and in 1799 obtained from Hunter a small grant of town land opposite the barracks, where is now the north-eastern corner of George- and King-streets. Here he built a store—for he was a trader at heart, and a successful one during most of his life; a caustic account of the methods by which he contrived to profit commercially by his position as paymaster of his company will be found in the *Memoirs of Joseph Holt*. In 1800-1 he visited England on leave. On 17 September 1802 he was admitted a master mason at the first lodge known to have been assembled in Australia (see FREEMASONRY), by officers of Baudin's expedition: it is curious that within a fortnight he was spreading reports that these very officers were selling liquor illegally to convicts. He was forced to apologize for the slander, and the apology was officially accepted; but, when Governor King a little later suspected Baudin of an attempt to annex southern Tasmania, the French commander at once charged Kemp with being the author of that false rumour also. In January 1803 he was involved in a grave scandal; scurrilous attacks on King were found in his backyard, and the consequent court martial was interfered with by Major Johnston, then commanding the corps, who went so far as to defy King's definite orders in several important respects. In the end Kemp was acquitted, and King was asked by the authorities in London to acquiesce in this verdict for the sake of peace in the colony. In June 1804 Kemp was treasurer of the corps' committee of paymastership, but in the same year King sent him to Port Dalrymple in Tasmania as second in command to Colonel Paterson, and in 1806-7 he administered the settlement for seven months during Paterson's absence in Sydney. Towards the end of 1807 he went back to Sydney on sick leave, and so happened to be the senior officer (after the judge-advocate) of the court martial summoned to try John Macarthur on 25 January 1808; his refusal to sit with Atkins as judge-advocate initiated the Bligh mutiny (see BLIGH, WILLIAM). A strong supporter of Johnston, Kemp was made the mutineers' judge-advocate, was authorized to celebrate civil marriages, and obtained from Foveaux as a reward 24 cows and 500 acres of land. In December 1808 he resigned his judicial position to become commandant at Parramatta, and during 1809 obtained from Paterson a further grant of over 1400 acres. After Macquarie's arrival he was sent to England as a witness for Johnston and remained there until 1815, when, finding that the Paterson grants had been cancelled (though the Johnston grant was confirmed), he obtained leave to settle in Tasmania. Macquarie in 1816 made him a magistrate there, and Davey gave him 800 acres, which he located at Cross Marsh on the road between Hobart and Launceston. Putting his son in charge there, he became a merchant at Hobart, having for some years as a partner George Gatehouse who was afterwards a brewer at New Town. In 1817-19 he was involved in a series of unedifying quarrels with Davey and Sorell: both governors suspended him from the magistracy, and Sorell's action was emphatically confirmed by Macquarie. He gave voluminous and vindictive evidence against Sorell at Bigge's enquiry in 1820, but without convincing Bigge; a few years later, however, in January 1824, he withdrew his previous charges and testified that 'our Personal Rights and the General Security of Property will hardly find a more able and upright Protector than Lieutenant Governor Sorell.' By this time, indeed, he had settled down to a long life of commercial prosperity: he became a director of the Bank of Van Diemen's Land, and a leader both of the Presbyterian Church and of the merchants of Hobart in public movements (e.g. for the introduction of trial by jury and the abolition of press censorship). He died at Sandy Bay near Hobart on 28 November 1868.

Kendall, HENRY (1841-1882), son of Basil Kendall and his wife Melinda McNally (a granddaughter of Leonard McNally of the United Irishmen), was born on 18 April 1841 at Kirmington near Milton in southern New South Wales. His grandfather Thomas Kendall, a Lincolnshire man, was one of the first missionaries to New Zealand, and the first white man commissioned as a magistrate for that country. Arriving there in 1814, he was almost immediately able to compile a Maori-English primer which was printed at Sydney in 1815; in 1820 he accompanied some Maori chiefs to England and joined Professor Lee of Cambridge in writing the first grammar of the Maori language. His son Basil fought in the Chilean navy under Lord Dundonald, but returned to New South Wales and settled near Milton, whence he moved with his family (including the young Henry) to the Clarence River district in 1846. He died there about 1851.

Henry went back for a time to the south coast, and then spent two years (1855-7) as cabin-boy on board a brig of his uncle's that voyaged about the Pacific and up to Japan; this episode in his life, however, he found anything but pleasing. Coming back to Sydney in 1857, he found employment in a draper's shop in Pitt-street, and began to write verse, sending it to *The Australian Home Companion* (which published his first set of verses in 1859 and others in the two following years), the *Empire* (which brought him under the notice of Henry Parkes), and the *Sydney Morning Herald*. He was also brought into contact with J. L. Michael and Nicol D. Stenhouse (q.v.); Michael took him into his office, and carried him up to Grafton when he moved there in 1861. Restless, however, and wholly bent on verse-making, Kendall soon returned to Sydney and set himself to a serious poetical career. In 1862 he sent some poems to the *Cornhill Magazine* (of which Thackeray was editor), and later in the year sent others to the *Athenaeum*; *Cornhill* ignored him, but the *Athenaeum* printed some of the poems and became (and remained) a source of favourable criticism. In October of the same year—before anything was known of the fate of his English ventures—his first volume, *Poems and Songs*, was published at Sydney by J. R. Clarke, and was well reviewed. In August of 1863 Parkes got him a position in the surveyor-general's office, and in 1866 transferred him to his own (the colonial secretary's) department. Kendall took advantage of his easier circumstances to write verse steadily.

In 1868 a prize was offered in Melbourne for the best Australian poem; Kendall sent in three, and the judge—R. H. Horne, q.v.—not only awarded him the prize but said that if there had been three prizes the other two would

have been given to Kendall also. Vastly encouraged, Kendall decided to earn his living as a writer; in 1869 he resigned his official position, moved to Melbourne, and became a member of the coterie that included Marcus Clarke, G. G. McCrae and A. L. Gordon. But the venture was not a success, financially or otherwise. George Robertson, the great Melbourne bookseller of the time, published his second volume, *Leaves From Australian Forests*, and lost £90 over it. Poetical matter was ill-paid and not much wanted. In 1870 Kendall lost his first-born and favourite child, Araluen; he returned to Sydney in 1871, and sank into what he termed 'the shadow of 1872,' from which he was rescued by the devotion of his wife, and kindness of two friends, the Fagans, who in 1873 brought him and his family to their sawmill at Camden Haven. The next seven years were the serenest, and probably the happiest, of his life and produced some of his best poems, 'Orara,' 'Hy-Brasil,' 'Cooranbean,' 'After Many Years.' His third volume, *Songs from the Mountains*, was published in 1880 and made money for him, and he had already won a prize of £100 offered by the *Sydney Morning Herald* for a poem on the Sydney International Exhibition. In 1881 Henry Parkes, who never ceased to admire him, made him inspector of State forests; but exposure attendant on long journeys through the bush broke down his already weak frame, tubercular disease followed, and he died at Redfern on 1 August 1882. He was buried in the Waverley cemetery.

Kendall's work, being voluminous, is naturally unequal, and in a 'collected edition' may be unfairly judged. His attempts to be jocular were usually failures, for he knew little about men; nor was he in reality a close observer of nature. But there is no doubt about the true lyrical cry, the ear for delicately beautiful phrasing, the poignancy of emotion, which all his best work discloses, and the 'September in Australia' and 'Rose Lorraine' of his second volume and the poems already mentioned in his third are permanent possessions. By virtue of this and similar work he was for many years the one Australian poet whom British anthologists admitted on equal terms with British poets; and in the art of pure poetry no Australian writer has yet excelled him.

Kennedy, Sir Arthur Edward (1810-1883), born at Cultra in county Down on 9 April 1810 and educated at Trinity College, Dublin, entered the army in 1827 as ensign in the 27th foot, in 1840 was commissioned captain in the 68th foot, and retired in 1848 to enter the colonial service. In 1846 he had been seconded as poor-law inspector in Ireland, and during the famine served on Sir J. Burgoyne's relief committee. In 1851 he was made governor of Gambia, in 1852 transferred to Sierra Leone, and in 1854 appointed in addition consul-general for the Sherbro district, which at the time was not a part of the colony proper. In 1855 he was again transferred, this time to Western Australia, where he was governor from 23 July 1855 to 17 February 1862. Thence he went to Vancouver Island (1863-7), West Africa (1867-72), and Hong Kong (1872-7), returning to Australia in 1877 as governor of Queensland; it is noteworthy that from 10 April to 20 July of that year he was merely administrator of the Queensland government, as he reached the colony much earlier than did the letters patent constituting him governor. Unassuming and kindly, he served his term without many eventful happenings; but almost his last act was to acquiesce (unofficially) in McIlwraith's daring, illegal, and ineffective annexation of eastern New Guinea to prevent the Germans from taking it. Leaving Brisbane on 2 May 1883, he was on his way back to England when he died at Aden on 3 June. (C.B., 1862; Kt. Bach., 1867; K.C.M.G., 1871; G.C.M.G., 1881.)

Kennedya, a genus of the family Leguminosae, consisting of twining or prostrate shrubs, endemic in Australia. The flowers are red, violet to purple; leaves simple, or divided into three leaflets; pods compressed, with pithy partitions between the seeds—when ripe they burst with

Kennedya monophylla.

considerable violence, thus widely scattering the seeds. *K. monophylla* is the 'false sarsaparilla,' frequently mistaken for the native sarsaparilla (see Smilax). *K. Comptoniana*, a Western Australian species, is a handsome climber with numerous trusses of bright blue flowers; it is easily raised from seeds, and makes a rapid growth.

Kennion, George Wyndham (1845-1922), born on 5 September 1845 at Harrogate in Yorkshire and educated at Eton and at Oriel College, Oxford (B.A., 1867; M.A., 1871), took holy orders in 1869 (priest, 1870) and after two years' service as diocesan inspector of schools was made vicar of St. Paul's, Hull (1873-6) and of All Saints, Bradford (1876-82). In 1882 he was chosen to be bishop of Adelaide, consecrated in November, and reached Adelaide early in 1883. During the next 12 years he greatly developed church organizations and, outside his diocesan work, encouraged the improvement of higher education: from 1887 to 1894 he was an active member of the council of the university. In 1894 he was translated to the

English see of Bath and Wells, and administered that diocese till his death on 19 May 1922.

Kent, THOMAS, of whose history before 1807 nothing is known, in that year determined to migrate to Port Dalrymple. Fortified with recommendations from ex-governor King and the whaling magnate Samuel Enderby (whose name is perpetuated in Enderby Land in the Antarctic), he obtained from the colonial office an order on Governor Bligh for 600 acres of land and the use of six convicts. Reaching Sydney on 27 November 1808 in the ship *Speke*, Kent found Bligh under arrest and unable to help him: he therefore at once went into partnership with a Bengal merchant, J. C. Burton, in a project for growing and manufacturing hemp with the aid of 'twenty native Indians or Chinese,' and Colonel Paterson gave the partners 500 acres near Toongabbie, allowing Kent a separate area of 1230 acres north of Cobbitty. Nothing came of this project, and in January 1810 Kent joined Simeon Lord (q.v.) in a plan for manufacturing cordage in New Zealand from the native flax; Kent was to superintend the industry on the spot, and Macquarie agreed to make him a magistrate for New Zealand. The news of the *Boyd* massacre, however (for which see NEW ZEALAND), scared Kent, and he settled down on his Cobbitty farm. By 1813, however, he had moved to Tasmania, and in February Macquarie warned Davey that he was one of a number of 'designing characters' against whose 'plausible but interested projects and Speculations' the new lieutenant-governor must be on his guard. For the next few years the only records of Kent concern his quarrels with the governing authorities over land, over the price of hay, over the loss of spirits in bond, over the use of convict transports as merchantmen, and in 1817 Macquarie renewed to Sorell the warning he had given to Davey. But Kent's inventive genius was still active, and in April 1819 he submitted to Sorell proposals (*a*) for extracting tannin from wattle-bark, (*b*) for procuring soda from the local seaweeds. Sorell apparently remained uninterested, for Kent went off to Sydney and disposed of his discoveries to Simeon Lord, who sent him back to Tasmania to make up a parcel of tannin and soda and take it to England 'for tryal and sale amongst the manufacturers.' In October Kent approached Bigge on the subject, and in the following March (1820) gave evidence at Bigge's enquiry in Hobart that he had already despatched two tons of tannin extract. Early in 1822 he found it necessary to leave Tasmania hurriedly for England, where he stayed until 1828. In 1824 the Royal Society of Arts granted him 30 guineas for his tannin discoveries, and in 1828 the colonial office (apparently under the impression that he was visiting Australia for the first time) sent him to Sydney with a land-order on Darling for 5000 acres at once and another 5000 as soon as he should have exported 50 tons of wattle extract. But during his absence he had been made bankrupt in the colony, and on arrival his creditors had him gaoled and demanded the 5000 acres from Darling. The governor very wisely insisted on an arrangement, and Kent disappears from history while farming the grant for his creditors' benefit. His discovery, however, was well exploited by others. In 1825 Messrs. Petchey and Wood (the latter probably Patrick Wood of Hobart) received from the Royal Society of Arts a gold medal for their tannin extracts, and between 1831 and 1845 15,516 tons of wattle-bark were shipped to England from Launceston alone.

Kent, WILLIAM (1751-1812), born at Newcastle-on-Tyne in 1751, was a nephew of John Hunter, the second governor of New South Wales. He entered the navy when 12 years of age (midshipman, 1763; lieutenant, 1781; commander, 1802; post-captain, 1806), and went on active service in the Channel and North Sea from 1770 till 1795, when he was given command of H.M.S. *Supply* to accompany his uncle in H.M.S. *Reliance* to New South Wales. The *Supply* reached Port Jackson on 7 September 1795. The *Reliance* and *Supply* were then employed in bringing cattle to the colony, and in 1797 were sent to the Cape of Good Hope for live-stock and stores. While at Cape Town, Waterhouse (who was in command of the *Reliance*) and Kent heard of some pure-bred Spanish sheep for sale, and privately purchased them for the improvement of the flocks in New South Wales. On return to Sydney the *Supply* was condemned as unseaworthy; only Kent's good seamanship had brought her into port. Kent and his crew were then transferred to the *Buffalo*, in which he took Hunter back to England, leaving Sydney on 28 September 1800. King strongly recommended that he should be made lieutenant-governor of Norfolk Island. However, on arrival in England he was reappointed to the *Buffalo*, returned to Sydney on 16 October 1802, and was employed by King in survey work and the bringing of cattle from India; during one of these trips, on 19 May 1803, he discovered Port St. Vincent in New Caledonia. In October 1804 he conveyed Paterson and his party to occupy Port Dalrymple. On 24 May 1805 he was transferred to the *Investigator*, and ordered by King to take her home with despatches; he rounded the Horn in the depth of winter and reached Liverpool on 14 October. In November 1808 he was given command of H.M.S. *Agincourt* and on 26 June 1812 appointed to H.M.S. *Union*, but died at sea off Toulon on 29 August. Kent's letters to Banks (published in the *Historical Records of New South Wales*, vol. iv) show him to have been enterprising and acutely observant. In 1800 he took to England emus and black swans for Banks, as well as specimens of Australian iron ore, and was anxious that the British government should encourage the smelting of ore locally. On leaving Sydney in 1800 he sold his house in George-street to the government at its own valuation, to be used as an orphan institution. The Kent group of islands in Bass Strait was named after him. His only son, born in Sydney in 1799, also served in the navy.

Several of Kent's relatives served in Australian waters. BARTHOLOMEW KENT was in 1805 a lieutenant in the *Buffalo*, and followed his uncle William to the *Investigator*. WILLIAM GEORGE CARLILE KENT, brother of Bartholomew, joined the navy in 1796, served as a midshipman with Sir Sidney Smith in the *Tigre* at the defence of St. Jean d'Acre in 1799, came to New South Wales with his uncle in 1802, was made by King lieutenant of the *Buffalo* in August 1805 and by Bligh lieutenant of the *Porpoise* in January 1807, transferred later in that year to the command of the *Lady Nelson*, and made by Bligh commander of H.M.S. *Porpoise* in March 1808 (after the mutiny); but, as he considered it his duty to obey orders from the *de facto* authorities in Sydney, Bligh on 1 January 1809 dismissed him from the *Porpoise* and put

him under arrest. After 23 months' confinement he was tried by court martial on 8 January 1811, and honourably acquitted.

Besides the three Kents mentioned above (who in 1802-5 were simultaneously commander, lieutenant, and midshipman in the *Buffalo*), RICHARD KENT, a naval surgeon by profession, and not related to the others, was appointed superintendent of convicts aboard the transport *Boddingtons* in 1792 and visited Port Jackson in 1793-4. Grose for some unknown reason describes him as a 'naval agent.' For THOMAS KENT, who also was in no way related to William, see the article under his name. Kent-street in Sydney took its name from none of the five, being named after Edward, Duke of Kent, a son of George III.

Kerferd, GEORGE BRISCOE (1831-1889), born in Liverpool in 1831, migrated to Victoria in 1852, and settled at Beechworth, of which town he was mayor four times in succession. In 1867 he was called to the Victorian bar. In 1864 he was elected to the legislative assembly as member for the Ovens. In June 1872 he joined the Francis ministry as solicitor-general, became attorney-general in May 1874, and at the end of July succeeded Francis in the premiership, taking in James Service as his treasurer. A year later he resigned, but was attorney-general in the McCulloch ministry of 1875-7 and the Service ministries of 1880 and 1883-6. While out of office in 1877-80 he helped to compile a digest of supreme court decisions between 1846 and 1871. In 1883 he represented his colony at the intercolonial conference that originated a federal council. In January 1886 he was raised to the supreme court bench—an appointment that was much criticized by the profession but warmly approved by politicians. The criticism he soon lived down, and his best-known decision as a judge—when he concurred with Chief Justice Higinbotham in upholding the right of any colony to impose what conditions it chose on the admission of aliens—though overruled by a majority of the court (Ah Toy *v.* Musgrove), was upheld on appeal by the privy council. He died on 31 December 1889.

Kestrel. See HAWKS.

Kidston, WILLIAM (1849-1919), born at Falkirk, Scotland, in August 1849, educated at Falkirk, and trained to be a machine-fitter, in 1882 migrated to Sydney and soon afterwards went to Rockhampton in Queensland, where he became a bookseller. In 1893 he contested Rockhampton in the Labour interest, and was defeated, but in 1896 was returned at the head of the poll. Re-elected in March 1899, he was from 1 to 7 December 1899 treasurer and postmaster-general in the short-lived Dawson ministry. From 1900 onwards he was leader of the opposition, and on 17 September 1903 became treasurer in the Morgan ministry at the head of the Labour section in that coalition. He soon established a reputation both for ability and for strength, and his grasp of public finance ensured that, when in January 1906 Morgan resigned office, he should be the inevitable successor. In his first ministry (1906-7) he was premier, chief secretary, treasurer, and vice-president of the executive council. At the general election of 1907 he dissociated himself from the Labour party, but was again returned for Rockhampton; on 19 November he resigned the premiership and was succeeded by Robert Philp, but on 18 February 1908 returned to office as premier, chief secretary, and vice-president of the executive council; and in 1909 formed a coalition with the remains of Philp's party. On 7 February 1911 he retired from politics and soon afterwards was appointed a member of the land court. He died on 25 October 1919.

Kidston's legislative record was not large, though he had to his credit the university act of 1909, the mining on private lands act of the same year, a good deal of land legislation in 1906-10 which was mainly the work of J. T. Bell (see BELL, SIR J. P.), and the constitutional reforms of 1908 that severely limited the power of the legislative council and prepared the way for its abolition in 1922. But he was a strong administrator, especially of the treasury, and during his premiership restored the State's finances to a thoroughly healthy condition; his opinion on financial matters was also valued highly in inter-State conferences. Probably his most important contribution to the welfare of his State was his conception of the great railway scheme, now (1925) half completed, whereby Queensland is to be gridironed by two parallel lines, from Thargomindah to Camooweal on the west and from Brisbane to Cairns in the east, with four crossbars through Cunnamulla, Roma, Longreach, and Hughenden.

Killer. See WHALES.

Kinchela, JOHN, a lawyer who had been in the public service in the West Indies and recorder of Kilkenny, was in July 1830 appointed attorney-general of New South Wales and reached the colony in June 1831; he was immediately appointed to the legislative council, and held his seat there until November 1837. Unfortunately he was so deaf that Bourke in 1832 declared him 'nearly incapable of getting through the business required of him'—and suggested that he should be made a puisne judge in Tasmania. In August 1833 J. H. Plunkett, then solicitor-general, was deputed to relieve him of all work in court. For the next few years he was continually being harassed by the demands of his creditors in England, and it became apparent that he had been given the appointment in New South Wales in the hope that he would be able to save money and discharge a load of debt. In 1835 Bourke again called attention to the evils arising from Kinchela's deafness, and in February 1836 the colonial office at last decided to retire him, giving him the first vacant office in which deafness would not be detrimental. Bourke meanwhile gave him in April an acting puisne judgeship (due to the absence of chief justice Forbes on leave), apparently considering deafness no defect in a judge (Kinchela had been deaf, he explained, while recorder of Kilkenny without harmful results). Bourke's persistence is rather remarkable. In December 1836 he again suggested making Kinchela a puisne judge in Tasmania; in June 1837 he proposed him as a fourth (equity) judge in New South Wales. But the colonial office stood firm in its belief that deafness was a disqualification for the bench, and suggested a pension of £500 a year. At the moment when this proposal was laid before the legislative council (October 1838) the granting of pensions was disfavoured, and Gipps evaded the difficulty by making Kinchela 'advising counsel to the government' with a salary of £500. This practically honorary position he retained until his death on 21 January 1845. In 1840 Gipps also made him commissary of the vice-admiralty court. On 2 September of that year his son took occasion to horsewhip James Mudie, who in his *Felonry of New South*

Wales had attacked the father; when the matter came into court, the jury awarded Mudie £50, 'being one pound for every blow the plaintiff had received,'—and the amount was raised at once by public subscription.

King, JAMES, usually known as James King of Irrawang, migrated to New South Wales in 1826, and on reaching the colony in 1827 obtained a grant of about 2000 acres on the Williams River near Raymond Terrace. Here he grew grain and raised cattle, but his main business—that of a merchant—he carried on simultaneously in Sydney. In 1831 he discovered between Sydney and Botany Bay a deposit of 'fine white sand . . . better suited for the manufacture of fine plate and flint glass than any found in England.' English glass-makers reported very favourably on the sand, and King demanded as reward 50 acres of either 'Goose Farm' (i.e. Grose Farm, now the site of the university of Sydney) or the Sydney Domain. In 1833 the executive council, at the suggestion of the colonial office, granted him a remission of £100 on the price of any land he might desire to purchase, but refused any further reward. In 1834 it was found that the cost of carrying the sand to England was almost prohibitive, but the potential value of King's discovery was recognized by the gift of the silver medal of the Society of Arts. Unable to obtain further recognition, he seems to have dropped the sand enterprise, settled down at his Williams River estate (which he named Irrawang), and divided his attention between grape-growing and pottery works. In 1838 he was selling good earthenware in Sydney. His development of the wine-making industry became important. In 1832 he planted his first vineyard, and in February 1836 made wine from its grapes: his vines came from Spain, Portugal, and France, a shipment from Rhine vineyards having proved a failure. His white wines are described as resembling hock or sauterne: his red wine was a burgundy. In 1850 the Horticultural Society of Sydney gave him its gold medal for light sparkling wines and white wines, and at the Paris exhibition of 1854 he was also awarded a medal, and his wine was served at the emperor's table. Some years earlier his work had attracted the notice of Baron von Liebig, who warmly approved of his provisional blendings and other experiments in wine-making. When in 1855 King visited Europe, he spent some time with von Liebig at Munich, met the grand duke of Nassau, and was told that his best red wines equalled the produce of the famous Assmannshausen vineyards. In 1857 he printed in Edinburgh for private circulation *Australia may be an Extensive Wine-growing Country.* Ill-health prevented him from returning to New South Wales.

In 1888 William Roberts of Penrith, who had married King's widow, left to the university of Sydney £4000 to found a scholarship in memory of James King: this is awarded biennially to enable the holder to study in Europe or the United States, and already several winners of it have become professors in Australian universities.

King, PHILIP GIDLEY (1758-1808), born at Launceston in Cornwall on 23 April 1758 and rated midshipman in H.M.S. *Swallow* in 1770 (lieutenant, 1778; commander, 1791; captain, 1800), during the following 13 years served in East Indian, North American, and home waters, and in January 1783 was appointed to H.M.S. *Europe,* then commanded by Arthur Phillip. Phillip strongly favoured the young officer, and when given charge of the expedition to Botany Bay in 1786 took King with him in the *Sirius* (see FIRST FLEET) and then in the *Supply.* A few days after landing King was chosen—probably as a fluent French scholar—to call officially on La Pérouse. On 1 February 1788 Phillip appointed him superintendent and commandant of the settlement to be established at Norfolk Island, and on the 15th he embarked with a small company of 23 (including 9 male and 6 female convicts), and reached his destination on 6 March. Apart from administering justice in the little community and receiving the newcomers sent over by Phillip, his chief work lay in cultivating the soil and fostering the increase of the introduced stock. In March 1790 he was recalled by Phillip to carry despatches to England, and so missed the mail bearing his commission as lieutenant-governor of Norfolk Island —a promotion recommended by Phillip even before he received King's first report. After three months in London he returned to his duties on 4 November 1791, and complained at once of the inefficiency of Major Ross, who had been in charge during his absence. The population now numbered 1000, but by 1793, thanks to King's care, they were independent of grain supplies from Sydney; in the following year the importation of animal food ceased, and after that date the surplus of foodstuffs allowed of an increasing exportation. When Phillip retired, King found himself the subordinate of Major Grose of the New South Wales Corps, and friction with the military authorities ensued; in 1793 members of the island garrison caused disturbances among the convicts, as a result of which the soldiers mutinied, some of them being sent later on to Sydney for trial. King was granted sick-leave in August 1796 and arrived in England on 6 May 1797. His prospects at the time were not bright, and his request for promotion to the rank of post-captain was refused. Banks, however, stood his friend and obtained for him a dormant commission as governor of New South Wales in the event of the death or absence of Governor Hunter; but the commission was limited in scope, and the titles of captain-general and governor-in-chief were withheld. The re-embarkation of King and his family was delayed until the departure of the transport *Speedy* on 26 November 1799, when the letter recalling Hunter was also despatched. The recall was not urgent, and Hunter retained his office until 28 September 1800, despite strained relations with King, who was waiting to take over the government. King was provided with no written instructions (save those he borrowed from Hunter) until 1802, when they were forwarded together with his full commission as captain-general and governor-in-chief of New South Wales.

The officers of the New South Wales Corps had continually opposed Hunter, and were no more friendly with King. John Macarthur (q.v.) tried to arrange a boycott of the governor; when his superior officer, Paterson, opposed it, Macarthur met him in a duel in which Paterson was severely wounded. King thereupon sent Macarthur to England for trial, but the British military authorities insisted that he should be tried in the colony, and Macarthur solved the difficulty by resigning his commission and returning to New South Wales as a civilian—a position in which he could give King more trouble than ever. Further friction with the Corps was caused by a charge made by Anthony Fenn Kemp, one of its officers, against officers of

the French expedition under Baudin; this, after some acrimonious correspondence between King and Paterson, had to be withdrawn. The governor himself, too, suffered from malicious libels (see PIPES) circulated if not originated by officers of the Corps: King ordered the holding of courts martial on the offenders, and in the quarrel that ensued much petty vindictiveness was shown on both sides. Possibly the large number of pardons to convicts granted by King (78 per annum, as against Hunter's 36) may be explained by his desire to build up a strong class of emancipists as a counterpoise to military domination.

It was in this atmosphere of mutual hostility that King had to administer the colony. One of his first acts was to announce to the officers, civil and military, that all manner of traffic carried on by persons bearing the king's commission was strictly forbidden. Thereafter he made spasmodic efforts to control the liquor traffic by sending away cargoes brought to port, but without much success. The general trading monopoly enjoyed for so long by the officers was limited, however, by an extension of the system originated under Hunter of selling necessary articles at a fixed price from the public store, and also by the development of legitimate private trade, mainly by Robert Campbell (q.v.) and William Tough. As a result the excessive price of the necessaries of life declined, agriculture revived, and the number of people supporting themselves without government assistance increased from 1635 on 28 September 1800 to 3747 on 3 October 1802, the number victualled from the public store remaining stationary. The regular despatch of supplies from England also enabled King to reduce the amount of bills drawn on the British treasury, and he effected further economies by promoting the cultivation of public land and the manufacture of linen and wool, by regulating the currency (q.v.), and by instituting a quarterly settlement of government accounts.

During the whole of King's term of office the colony was disturbed by the presence of the disaffected Irish prisoners (see IRISH EXILES). Their first conspiracy to overthrow the government was abortive, but a second attempt in 1804 resulted in open rebellion, which was crushed by the prompt action of the governor and of Major George Johnston. In order to remove the Irish leaders from contact with the general community King reoccupied Newcastle on the Hunter River, which had been temporarily settled in 1803, and so further extended the area of his active jurisdiction. This had already been increased by a settlement on the Derwent River under Lieutenant John Bowen (q.v.) and a later one on the Tamar by Lieutenant-colonel Paterson. King Island in Bass Strait was occupied by Lieutenant Robbins to forestall a suspected annexation by Baudin. Meanwhile the abandonment of Norfolk Island had been officially decided on—but it took a number of years to remove all the settlers. The original settlement at Port Jackson was extending coastwise, the Blue Mountains still presenting an effective barrier to inland development. King was interested in exploration, and in 1801 despatched Lieutenant John Murray on the voyage that resulted in the discovery of Port Phillip; later in the year he sent Lieutenant James Grant to examine the Hunter River; he also prepared the first fully equipped party for land exploration under Ensign Barrallier. Among other useful measures he in 1803 allowed George Howe, the government printer, to publish weekly the *Sydney Gazette*, 'it being desirable that the settlers and inhabitants at large should be benefited by useful information being dispersed among them;' he also established a much-needed orphans' institute, and endowed it with a grant of land. His advocacy of judicial reforms was unheeded by the colonial office. In his public acts King was as a rule undoubtedly disinterested, though in one or two cases—notably in respect of certain land grants made by him to his successor, Bligh, and by Bligh to him—his powers were certainly used for the benefit of his family. His constant quarrels with the military, and their consequent attacks on him in letters to England, induced him as early as May 1803 to apply for leave to retire; but, though Lord Hobart in November of the same year gave him the required leave, it took so long to choose a capable successor that it was not until August 1806 that he was able to resign. Bligh took over on 13 August, and King, assuming command of H.M.S. *Buffalo*, sailed for England via Cape Horn on 10 February 1807, but did not reach his destination until November. Severe attacks of gout broke down his health completely, and he died at Tooting near London on 3 September 1808.

King, PHILLIP PARKER (1791-1856), born on 13 December 1791, while his father Philip Gidley King was in command at Norfolk Island, entered the navy in November 1807 (midshipman, 1808; lieutenant, 1814; commander, 1821; post-captain, 1830; rear-admiral, 1855), served in the *Diana* on the French coast—where he was commended for gallantry—and in the *Hibernia*, *Centaur*, and *Cumberland* in the Mediterranean until the close of 1811. During the next six years he was in the *Adamant*, *Armada*, *Caledonia* (Sir Edward Pellew's flagship), *Trident*, and *Elizabeth* (the flagship at Gibraltar in 1814), and in February 1817 was selected to carry out a survey of those parts of the Australian coast which Flinders had been compelled to leave unsurveyed. This survey, which is described under EXPLORATION BY SEA, lasted from December 1817 to April 1822; King returned to England in April 1823, worked up his charts, and published his *Narrative of the Survey of the Intertropical and Western Coasts of Australia* in 1827. In September 1825 he was appointed to the sloop *Adventure* for survey work on the south coast of South America, the *Beagle* aiding him. During his absence from Australia he was in 1829 nominated to the New South Wales legislative council, but the appointment lapsed because he could not take his seat within the year. On the return of the *Adventure* in November 1830 he went on half-pay, and in 1831 took up his residence in New South Wales. On 12 February 1839 Gipps appointed him to the legislative council, but on 8 April he became managing commissioner of the Australian Agricultural Company (q.v.), and at once offered to resign his seat in the council; Gipps referred the matter to London, and the resignation was accepted in October. At the end of 1849, the Australian Agricultural Company having abolished the office of commissioner, King retired to his own estate. In May 1850 he was nominated to the council, and in September 1851 was elected to it as member for Gloucester and Macquarie counties. He died on 26 February 1856.—His son, PHILIP GIDLEY KING (1817-1904), born at Parramatta in 1817, served in the *Adventure* and afterwards in the *Beagle* under Robert Fitzroy, but in 1836 left the navy and in 1839 joined his father in the

service of the Australian Agricultural Company. In 1851 he was made superintendent of stock at Port Stephens, and in 1853 manager of the Peel River Company's estates on the Liverpool plains. In December 1880 he was nominated to the legislative council of New South Wales. He died on 5 August 1904.

It should be noted that, whereas Governor King and his grandson were both christened 'Philip,' P. P. King the explorer was christened 'Phillip' because of his father's great admiration for the governor of that name.

King, WILLIAM FRANCIS (1807-1874), born in London in March 1807, was the son of Francis King, paymaster of petty accounts at Whitehall. He was educated for the church, but preferred other work, entered a stockbroking firm, and later on became a clerk in the treasury office at the Tower of London. In 1829 he migrated to New South Wales, bringing credentials to Bishop Broughton who appointed him schoolmaster and clerk at Sutton Forest. Tiring of this work, he for several years acted as a tutor, and then drifted to Sydney, where he worked as a pieman and a hotel barman. His chief means of support, however, was an allowance made by his father. His well-known nickname, 'The Flying Pieman,' was acquired by a remarkable series of walking feats, one of the first being a walk of 1634 miles in 5 weeks and 4 days, for his own gratification. On two occasions he beat the coach from Windsor to Sydney (34 miles) by several minutes; he walked from Sydney to Parramatta (15 miles) and back twice a day for six consecutive days, and on three consecutive days from St. John's church at Parramatta to St. Matthew's at Windsor and back —a distance of 43½ miles; on the first day he took 8 hours, on the second 7½ hours, on the third 7 hours 25 minutes. Among many other feats he carried a dog weighing 70lb. from Campbelltown to Sydney (33 miles) between 12.30 a.m. and 8.40 a.m.—20 minutes over the wagered time—and a live goat weighing 92lb. from Talbot's inn on Brickfield Hill to Andrew Nash's Woolpack inn at Parramatta in 7 hours. He died on 12 August 1874 in the Liverpool asylum for old men.

Kingfish, a name applied in New South Wales and Queensland to a species (*Seriola grandis*) of the trevally family. In the southern States a very different fish, *Sciaena antarctica* (see JEWFISH), is called 'kingfish;' in Queensland the name is also used for *Scomberomorus* (see MACKERELS); the Tasmanian kingfish (*Jor-*

Seriola grandis.

danidia solandri) is a barracouta (q.v.). Many species of *Seriola* occur in all temperate and tropical seas, and several are known from the coasts of Australia. *S. grandis*, which may reach a length of six feet, is plentiful at certain seasons, and provides good sport for rod-fishermen. It usually moves in shoals, and may be taken wholesale in nets; but its flesh is apt to deteriorate rapidly in warm weather, so that as a marketable fish it does not find favour. The allied Samson-fish (*S. hippos*) is so far known only from the coast of New South Wales; it reaches a length of two feet, and is usually captured in the open sea, only young specimens entering inlets.

A.R.McC.

Kingfishers and Bee-eaters, brilliantly plumaged birds with long beaks, that feed on small fish, reptiles and insects and lay white eggs in holes in trees or in the ground. The true kingfishers (Alcedinidae) are represented in Australia by only two species, of which the Blue Kingfisher (*Alcyone azurea*) is the more familiar. This bird frequents the shores of rivers and creeks throughout northern and eastern Australia and Tasmania, and is generally seen perching on an overhanging branch, from which it plunges into the water after small fish.

The forest kingfishers (Dacelonidae) are better

Kookaburra.

represented, Australia possessing eight species. These birds are much less aquatic than the true kingfishers, many being found far from water and feeding on small reptiles and insects. By far the best-known is the Laughing Jackass or Kookaburra (*Dacelo gigas*). This familiar bird is naturally peculiar to eastern Australia, but has been introduced and established in south-western Australia and Tasmania. It was first figured and described in Sonnerat's *Voyage to New Guinea*, published in 1776, and was supposed to have come from that country. The bird frequents open forest country, and is sociable in habits. Its extraordinary laughing note, per-

haps the most familiar sound in the bush, may be heard at all times of the day, but especially at morning and evening; then one bird will begin and all the others in the neighbourhood chime in, till the bush resounds with wild, infectious merriment, 'a chorus of wild spirits' as Sturt called it. The Blue-winged Kookaburra (*Dacelo leachi*) of northern Australia and New Guinea has more colour in its plumage, and an entirely different call.

Other familiar members of this family are the Sacred Kingfisher (*Halcyon sanctus*) found

Forest Kingfisher.

throughout Australia and in many of the adjacent Pacific islands, and the Macleay or Forest Kingfisher (*Halcyon macleayi*) of northern and eastern Australia and New Guinea. All these kingfishers, including the kookaburra, are fond of making their nesting holes in the arboreal nests of termites, though in localities where these do not occur a hole in a tree is adopted. In order to excavate a hole in the very hard substance of the white-ants' nest, the birds fly straight at it from the nearest convenient branch, driving their stout wedge-shaped bills into the selected spot. These tactics are repeated again and again for days in succession, until the hole is large enough for their purpose. The kookaburra, being larger than its allies, adds to its diet lizards and snakes of

Bee-eater.

considerable size, as well as mice, rats and small birds, and sometimes even takes considerable numbers of chickens and ducklings; but its jovial laughter and its reputation for destroying snakes have made it a general favourite, and it is almost universally protected.

The Australian Bee-eater (*Merops ornatus*) is our sole representative of the family Meropidae, found throughout the warmer regions of the eastern hemisphere. Its brilliant plumage, in which blue, green and orange predominate, has earned it in some districts the name of rainbow-bird. Throughout the greater part of Australia it is a summer visitor, laying its white eggs in a hole in sandy ground. A number of pairs usually excavate their burrows close together. In autumn most of our bee-eaters pass northwards to the Malay Archipelago, though some remain in the northern parts of the continent. The bee-eater feeds on all sorts of insects, catching them on the wing, and is by no means restricted to a diet of bees, as its name would seem to imply. W.B.A.

King of the Herrings. See RIBBON-FISHES.

King's School, THE. See SCHOOLS.

Kingsley, HENRY (1830-1876), younger brother of Charles Kingsley the preacher and novelist, was born on 2 January 1830 at Barnack in Northamptonshire and educated at King's College, London, and Worcester College, Oxford. Before taking his degree he migrated to Victoria in 1853 to work on the goldfields, but had no luck there and drifted to the Western District of Victoria, where he stayed with William Mitchell of Langawilli and wrote his first novel, *Geoffry Hamlyn*, borrowing many of his names from the region between Geelong and Skipton. In 1858 he returned to England, published the novel in 1859, and followed it up with a series of eight (published between 1862 and 1871) of which the best and probably best-known is the first, *Ravenshoe*. Only in one of them, *The Hillyars and the Burtons* (1865) did he again use his Australian knowledge, and then not so much his actual experiences as the tales of other regions he had picked up. In 1870 he was a war-correspondent during the Franco-German war, and was the first Englishman into Sedan after the surrender; the strenuous occupation seems to have sapped his energies, and his later work betrays the strain. He died at Cuckfield in Sussex on 24 May 1876.

Henry Kingsley's writings, while less popular than those of his brother Charles, are by good critics ranked above them. In *Geoffry Hamlyn* he preserved a valuable record of the golden age of squatterdom, before the gold discoveries brought in an excitable and cosmopolitan crowd —and the record is contemporaneous, for no swarms from the Ballarat ant-heap had during the fifties found their way south of Skipton. Kingsley's work is a useful reminder that the settlement of Australia is not entirely bound up with convicts and drought-maimed explorers and the constitutional troubles of New South Wales governors.

Kingston, CHARLES CAMERON (1850-1908), younger son of Sir G. S. Kingston (q.v.), was born in Adelaide on 22 October 1850, educated locally, trained for the law, and admitted to the South Australian bar in 1873. He had served his articles in the office of S. J. Way (q.v.), with whom he stayed until Way became chief justice; he then practised on his own ac-

count, and in 1889 became a Q.C. Meanwhile he determined to enter politics, and was in 1881 elected to the assembly from West Adelaide, which constituency he represented until he left State politics in 1900. He soon came to the front, being attorney-general in the Colton (1884-5) and Playford (1887-9) ministries, chief secretary in the second Playford ministry (1892-3), and on 16 June in the last-named year forming a ministry in which he kept the premiership until 1899—a remarkable feat in a colony where no previous ministry had lasted more than three years, and the average duration had been less than 11 months.

Kingston was an 'advanced liberal;' his programme, almost the whole of which he carried out, included woman suffrage, generous factory legislation, 'progressive' taxation of land, incomes, and inherited wealth, industrial conciliation, a protective tariff, payment of members, and the establishment of a state bank. Being an excellent parliamentary draftsman, he constructed most of his own legislation, and saw to it that the intention was clear and was carried into effect. He was a strong opponent of non-European immigration, and consequently an early advocate of federation. In 1888 he persuaded the South Australian parliament to authorize the appointment of representatives on the federal council, though for two years only; he represented the colony on that council, and at the federal conventions of 1891 and 1897-8; he drafted the enabling bill by which the latter convention was made possible, presided over the convention itself, and took part both in the premiers' conference that gave the federal constitution what was practically its final shape and in the London negotiations which ensured the approval of the Imperial parliament. In 1901 South Australia returned him at the head of the poll to the house of representatives, and he became minister for trade and customs in the first (the Barton) federal ministry; he carried through the house a protective tariff which, though mild in comparison with those of more recent years, occasioned more bitter contests than any of them; and he attempted to persuade his colleagues to adopt a somewhat drastic arbitration bill, which would have extended federal control over the railways of the States. Resigning on this point, he was expected to become the next prime minister and leader of a labour-liberal coalition; but his health began to fail at the critical moment, and—though Adelaide re-elected him without a contest in 1903 and 1906—he gradually withdrew from active politics. He died at Adelaide on 11 May 1908. (P.C., 1897.)

Kingston, Sir George Strickland (1807-1880), born in England in 1807, was trained for the profession of land-surveying, and in 1836 was made assistant-surveyor and second in command to Colonel Light for the first settling of South Australia. He reached Nepean Bay in Kangaroo Island on 11 September, was sent on to Holdfast Bay early in November, discovered and traced the Torrens up and down, and pitched his camp on the site of Adelaide. Dissensions arising between Hindmarsh the governor and Light the surveyor-general, Kingston was sent back to England with despatches, and returned in 1838 with orders to supersede Light unless he quickened up his surveys; Light resented the order and resigned, and Kingston held the surveyor-generalship until the arrival of Charles Sturt (q.v.). In 1839 he was made inspector of public works, and in 1840 town surveyor. Holding aloof as a rule from local politics, he persistently opposed state aid to religion and took an active part in the 1845 protests against the introduction of convict labour. In 1849 he worked hard for the grant of responsible government, and was elected in 1851 to the enlarged legislative council as member for the Burra. In the debates of November 1855 on the details of the new constitution he threw his influence in favour of universal suffrage and vote by ballot, and forced the government to adopt them at least for the house of assembly. In the new legislature he was re-elected for the Burra, and was made speaker; losing his seat at the election of 1860, he remained out of politics for two years, but in 1863 was again returned for the Burra and in 1865 again made speaker, a position which he retained until his death. In 1880, while on a voyage to Ceylon for the benefit of his health, he was taken ill at sea and died on 26 November. (Kt. Bach., 1870.)

Kintore, Earl of. Sir Algernon Hawkins Thomond Keith-Falconer, 10th earl of Kintore, was born at Edinburgh on 12 August 1852, educated at Eton and Cambridge (B.A., 1874; M.A., 1877), and succeeded his father, the 9th earl, in 1880. From 1885 to 1889 he held minor appointments in the house of lords and about the court, and in the latter year was appointed governor of South Australia. During his term of office he took an active interest in the federal convention of 1891 and in the extension of the Oodnadatta railway northwards across the continent. Resigning the governorship on 10 April 1895, he returned to England and resumed the post of lord-in-waiting at the court, which he held until 1905. In 1913 he was made deputy-speaker of the house of lords. His court duties brought him decorations from Italy, Prussia, Portugal, and Sweden. (P.C., 1886; G.C.M.G., 1889.)

Kite. See Hawks.

Knibbs, Sir George Handley, born in Sydney on 13 June 1858 and educated as a surveyor, in 1877 joined the staff of the New South Wales survey department, and in 1889 was appointed to a lectureship in surveying and allied subjects in the university of Sydney. Nominally holding this (the P. N. Russell) lectureship until 1905, he was in 1902 despatched by the New South Wales government to the United Kingdom, continental Europe, Canada, and the United States to report on all branches of education. Shortly after his return he was appointed director of technical education (1905-6), and was also acting professor of physics at the university. He resigned his posts in 1906 to become Commonwealth statistician, and proceeded to create a statistical department whose efficiency has not been excelled elsewhere, and to issue a series of fourteen *Official Year Books* which are renowned the world over; he was also adviser to the federal government on many details of taxation, and devised the mathematical formulae which control Australian land- and income-tax rates. In 1921 he resigned the statisticianship, and became director of the Commonwealth Institute of Science and Industry (q.v.).

Apart from his work as lecturer and statistician, Knibbs has interested himself in many branches of science and many public questions. For nine years he was honorary secretary of the Royal Society of New South Wales, and its president in 1898-9. Over the Institution of Surveyors he presided for four years (1892-3

and 1900-1), over the Society for Child Study for three years (1903-5), and over the British Astronomical Society's New South Wales branch for two years (1897-8). He represented the Australian government at five international congresses, and at two Imperial conferences (on double income-tax and on statistical methods), and has been a member of royal commissions on insurance (1909-10) and taxation of crown leaseholds (1918-9); of the last-named he was chairman. During the war he was also a member of a royal commission on trade and industry and a consulting member of a committee on munitions, and carried out a war-census of persons fit for war-service, and another of the wealth of the Australian people.

He is a member of the Institut International de Statistique, an honorary member of the Societé de Statistique de Paris and of the American Statistical Association, an honorary fellow of the Royal Statistical Society, and a fellow of the Royal Astronomical Society. While at the university he put forth 36 pamphlets on physical, mathematical, engineering, and astronomical subjects, and in his later years a very large monograph on the mathematical theory of population and one on the census of wealth. He has also published two volumes of poems. (C.M.G., 1911; Kt. Bach., 1923.)

Knopwood, ROBERT (1761-1838), born in Norfolk, England, on 2 June 1761 and educated at Bury St. Edmunds and Caius College, Cambridge (M.A., 1784) inherited a large estate, but squandered it in his youth while the associate of Lord Claremont and other riotous livers of the late 18th century. He took holy orders while still young, but did not take them seriously; when, however, it became necessary to earn a living, he found himself qualified to be domestic chaplain to Earl Spencer, who was first lord of the admiralty from 1794 to 1801. In 1801-2 he was chaplain in H.M.S. *Resolution*. Towards the end of 1802 the British government decided to send an expedition to occupy Port Phillip, and put David Collins (q.v.) in charge of it; on 14 January 1803 Knopwood was commissioned chaplain to the expedition, sailed with Collins in the *Calcutta* on 27 April, and became one of his most valued officers both at Port Phillip and (when the settlement there was abandoned and the personnel removed to Tasmania) at Hobart. On 23 October he conducted the first religious service held on the soil of Victoria. As the *Calcutta* had reached the bay on the 9th, services had probably been already held aboard ship within the boundaries of Port Phillip, but this is the first recorded on land; it was held in front of Collins's camp on 'Sullivan Cove,' a little E. of Sorrento, and the convicts were ordered to attend it 'as clean as their present situation will admit.' On 15 February 1804 Knopwood reached Storm Bay, and on the 26th held his first services at the Tasmanian 'Sullivan Cove' in the morning and at Risdon in the afternoon. Being not only a minister of religion but also a commissioned official, he was appointed a magistrate both of the short-lived Port Phillip settlement and of that at Hobart, and (like his greater colleague Marsden) occasioned some scandal among pious settlers by devoting more attention to his civil than to his religious duties. His life in Tasmania (as well as his voyagings from 1801 onwards) is described in some detail by himself in a journal now in the Mitchell Library, of which a portion is to be found in Shillinglaw's *Historical Records of Port Phillip* (1879). As might have been expected from his antecedents, he soon gained the reputation of an unconventional 'good fellow,' full of sympathy and fond of wine—a type of clergyman well known in England in those days, but more conspicuous in a small and censorious community. Collins liked him well, and in 1809 officially commended 'his attention to the duties of his Office, and the readiness with which he has at all times assisted me in his Civil capacity as a Magistrate;' but Macquarie could not abide his unconventionality, suspected that it connoted loose living, and directed Davey (of all men!) to admonish him severely for any impropriety of conduct. Davey used him as an intermediary with Michael Howe's gang of bushrangers; and Sorell, when he succeeded Davey, found on record an 'extraordinary implication' against Knopwood made by Howe, charging him with complicity in their acts. Though absolutely acquitted of this charge, Knopwood felt it deeply, and his health broke down under it; Davey on 10 January 1817 reported his 'long and continued indisposition,' and Macquarie in transmitting the report to Bathurst described him as 'quite superannuated and infirm' and doing more harm than good at Hobart. In 1821, however, the bitter feeling had somewhat abated, and Macquarie recommended that he be allowed to retire on full pay—which was, after all, only 10s. per day. Bathurst refused full pay, but allowed him £100 a year and a grant of land. On 27 April 1823 Knopwood preached his last sermon in old St. David's (which was built in 1817-8), and retired to his grant of land at Rokeby on Ralph Bay, across the Derwent from Hobart. He continued unofficially to meet the religious needs of the neighbouring settlers, until on 4 March 1826 he was officially appointed to the parish of Clarence Plains (i.e. the district in which he was living). He died on 18 September 1838.

Knot. See WADERS.

Koala, often called 'native bear,' is an aberrant species (*Phascolarctus cinereus*) of the phalanger family (see OPOSSUMS), the only representative of its genus and sub-family. It ranges all over eastern Australia from Queensland to Victoria. It is a much larger animal than any of its nearest relatives, the true phalangers, having a length of about 42 inches; and it differs from them most conspicuously in the thickset body, the broad short muzzle, and the absence of a tail. The fur is thick and woolly, grey above, becoming yellowish-white on the hind-quarters, white or yellowish-white below. The ears are large and rounded, thickly covered with hairs, which on the backs are black tipped with white, white elsewhere. Both pairs of limbs are stout; the fore-limb has the five digits sub-equal, the first and second opposable to the other three, all with powerful pointed claws; the hind-limb has the first toe nailless and opposable, and the second and third syndactylous as in the rest of the family. There is a large glandular patch on the chest.

The koala is essentially an arboreal animal, and its movements when it descends to the ground are awkward and clumsy. The grasping power of its hands and feet, with their strong curved and pointed claws, enables it to climb with great sureness; even when severely wounded, it will not readily relax its hold. Mainly nocturnal, it may sometimes be seen moving about in the daytime, but usually passes the hours of daylight asleep in a fork or in the interior of a hollow trunk. Its food consists almost exclus-

ively of eucalyptus leaves, but it descends occasionally in search of other vegetation or to dig for certain roots; cheek-pouches serve for the temporary storage of food. Koalas usually live

Native Bear (Koala).

in pairs. Only one young one is produced at a birth; as in other marsupials, this is very small at first, and is retained in the pouch; when it becomes able to leave this shelter, it is carried about for some time clinging to its mother's back or shoulder. See MARSUPIALS. W. A. H.

Koel. See CUCKOOS.

Kookaburra. See KINGFISHERS AND BEE-EATERS.

Krefft, JOHANN LUDWIG GERHARD (1830-1880), born at Brunswick in Germany, at the age of 15 became a clerk in a large business house at Halberstadt, but, showing great taste for drawing and painting, in 1850 gave up commerce and went to the United States, where he was employed as a clerk and draughtsman. Having studied the illustrated works of Audubon in the New York mercantile library, he copied some of the plates, and by selling them obtained sufficient money to come to Australia. He landed in Melbourne in 1852, and worked on the goldfields until 1857. In 1858 he was selected as painter and naturalist to accompany a collecting expedition organized by the Victorian government; of this he became leader, and brought back to Melbourne a large number of botanical specimens and a well-filled sketch-book—in consequence of which he was made by Professor McCoy an assistant in the Melbourne museum. Almost immediately, however, he revisited Germany and, making a short stay in South Africa on his way back, in 1860 settled in Sydney, where he was appointed secretary to the Australian Museum and assistant to the curator, Dr. Pittard. On the death of his chief in 1861 Krefft became curator, and employed his spare time in publishing valuable monographs on various Australian animals. In 1874 he resigned on account of differences with the trustees, retired into private life, and died on 18 February 1880.

His principal works are *Snakes of Australia* (1865-9), *Australian Vertebrata* (1865-73), and *Mammals of Australia* (1871), all published in Sydney. He was the first to describe scientifically *Ceratodus* (q.v.), which had been discovered in Queensland by William Forster and submitted to Krefft for examination; and his demonstration of its connection with certain fossil forms was acknowledged as decisive and valuable by Agassiz. His work in connection with extinct giant marsupials was used and praised by Sir R. Owen.

Kunzea, a genus of the family Myrtaceae, limited to Australia, consisting of heath-like shrubs. The flowers are white, lilac-purple, or yellow; calyx-tube globular, with 5 lobes, green or scarious at the edges; petals 5, orbicular; stamens free, in one to several series; capsule not woody. *K. corifolia* (Tick-bush), a spreading floriferous shrub, is reputed to be frequented by ticks. *K. Muelleri*, a low spreading undershrub with bright yellow flowers, is an alpine species. The wood of *K. peduncularis* was used by the aborigines for making waddies or clubs.

Kurnell. See EXPLORATION BY SEA.

Kurrajong, aboriginal name of several trees belonging to the orders Sterculiaceae and Malvaceae, and occasionally to other trees with a tough bark, but of late years confined to the Black Kurrajong (*Brachychiton populneum*, syn.

Black Kurrajong.

Sterculia diversifolia), an umbrageous tree that ranges from Gippsland to the Gulf of Carpentaria, with a preference for limestone country.

It attains a height of 60 feet. The flowers occur in sprays; calyx bell-shaped, yellowish without, reddish within; petals obsolete; fruit a follicle 1½ to 2 inches long, thick and leathery; leaves on long stalks, shining, very variable in form, some being entire and shaped like a poplar leaf, others more or less deeply 3-lobed (rarely 5-lobed). A white gum is exuded.

The kurrajong is the best Australian fodder-tree; cattle and sheep devour the leaves eagerly, and in dry seasons have been known to exist for long periods with hardly any other food. Branches within the reach of grazing animals are always cropped. In New South Wales the trees are exempt from timber licences, and may not be cut down, though they may be lopped. Pastoralists are beginning to make small kurrajong plantations, as the trees grow readily from seed, taking six or seven years to become established. A strong fibre made from the bark is used by the aborigines to make fishing-nets and dilly-bags; they also eat the young roots, which when boiled have a flavour like that of turnips, but sweeter. The kurrajong is an ornamental tree, suitable for parks and gardens.

Other trees to which the name 'kurrajong' has been applied in the past are *Commersonia echinata* (Brown K.), *Brachychiton Gregorii* (Brown K.), both of the Sterculiaceae; *Hibiscus heterophyllus* (Green K.), *Plagianthus sidoides* (Tasmanian K.), both of the Malvaceae. It has also been occasionally applied to a *Trema* (Urticaceae) and to a *Pimelea* (Thymelaceae). The spelling varies greatly, currajong, currijong, and koorajong being the variants most frequently met with.

Kurrajong, the name of a hill district overlooking the Hawkesbury valley near Richmond in New South Wales, named from the profusion of kurrajong trees with which it was originally covered and which still clothe its upper slopes. It is now known as a health resort and a good situation for citrus orchards.

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Labiatae. a large family of plants of world-wide distribution, including the well-known culinary herbs mint, thyme, and sage. Twenty genera with 148 species are indigenous to Australia; only five genera are endemic. *Anisomeles salvifolia* is said to yield a delicate perfume; *Coleus* is a tropical genus, but is represented in Australia by *C. scutellarioides;* of *Dysophylla,* whose leaves often have a fetid odour, the Australian species is *D. verticillata. Prunella, a small* genus, is represented by *P. vulgaris,* the common 'self-heal' of Europe. The indigenous *Salvia plebeia* extends to eastern Asia. *Westringia rosmariniformis* (Coast Rosemary) is a useful protective shrub, suitable for exposed positions on the sea-coast. See MENTHA, OCIMUM, PROSTANTHERA.

Labillière, FRANCIS PETER (1840-1895), born on 13 August 1840 at Melbourne, in 1859 went to England with his father, entered the Middle Temple, and was called to the bar on 6 June 1863. From 1869 onwards he advocated imperial federation, and in 1884 was made secretary of the Imperial Federation League. In 1874 he urged the colonial office to annex eastern New Guinea. In 1878-9 he published in London a two-volume *Early History of the Colony of Victoria* which at the time added a good deal to historical knowledge. He died in England in 1895.

Labour Parties. As early as 1842 there are traces of a tendency among artisans and manufacturers' employees to become politically active as a class; but the associations which they formed or joined, such as the Mutual Protection Association of Sydney (1844), included small tradesmen and farmers, and so were not avowedly 'labour' organizations. The gold discoveries, which allowed every man to gamble for wealth and enriched many who had formerly been employees, for a time allayed industrial discontent; but from the mid-sixties onwards the formation of trade unions (q.v.) proceeded with some vigour, and in 1872 the miners of Bendigo in Victoria formed an association which grew into the Amalgamated Miners' Association of Victoria, the first industrial body to exercise any important political influence. Isolated attempts were soon made by local groups to return 'labour' representatives to the colonial parliaments; and in 1884 an intercolonial trade-union congress, held in Melbourne, urged organizations in the various colonies to elect a parliamentary committee, and where possible to obtain for labour direct representation in parliament. The formation of the Australian Socialist League in Sydney in 1887, the writings of William Lane (q.v.), and the visit of Henry George, stirred up political enthusiasm, and at the Hobart conference of 1889—when the Australian Federation of Labour was formed—it was resolved not to support candidates who did not adhere to the labour platform. Acts providing for the payment of members, which were passed in all the colonies by 1890, made it possible for a working-man to devote all his time to parliamentary work. Then followed the maritime strike of 1890 (see STRIKES) in which all the important unions became involved; its failure convinced unionists of the difficulty of securing reforms by direct industrial action when the government was hostile. Action was therefore taken to form a political labour party in all the colonies except Tasmania. In *New South Wales* the trade unions of Balmain had sent Jacob Garrard to parliament in 1880, undertaking to pay him a salary; the experiment was not a success, and he attached himself to one of the existing parties. In 1883 Angus Cameron was elected by West Sydney to represent labour; Frank Cotton stood in the same interest for East Sydney in 1890, but was defeated. After the failure of the 1890 strike a constitution for the proposed party, and a platform for submission to the electors of New South Wales, were drafted and approved by a labour conference; labour electoral leagues were rapidly and widely organized, and in June 1891 45 candidates faced the general election, 36 being returned. Of these 16 were elected by city and suburban constituencies, 4 by coal-miners, and 16 by agricultural and pastoral constituencies. Among the new members were J. S. T. McGowen and Joseph Cook, both of whom in later years held high office. This remarkable success at the polls was partly due to the stirring speeches made by Sir George Grey (q.v.).

If it could retain its 'solidarity,' the party held the balance of power in a house of 141; but its first pledge—'to vote in the House as a majority of the Party, sitting in caucus, has determined'—proved unworkable, and schisms occurred whenever the fiscal question (at that time the chief matter in dispute between the other political parties) was raised. General support was, however, given to Parkes, who had placed on his programme seven labour measures, including bills for electoral reform, the extension of local government, and the improvement of conditions in coal-mines, workshops and factories. When, however, Parkes refused to accept their proposals for the shortening of coal-miners' working hours, the labour members abandoned him, and George Dibbs, becoming premier, introduced a protectionist tariff and split the party hopelessly. At the elections of 1894 two sections—one pledged, the other independent—sought the labour vote, and 27 members (15 of whom were pledged) were returned to a parliament of 125; among them were J. C. Watson (q.v.) and W. M. Hughes (q.v.). After some negotiations the sections united, on the basis of the following pledge, which remained practically unchanged for twenty years:—

> I hereby pledge myself not to oppose the selected candidate of this or any other Branch of the Political Labour League. I also pledge myself, if returned to Parliament, on all occasions to do my utmost to secure the carrying out of the principles embodied in the Labour Platform, and on all questions, and especially on questions affecting the fate of a Government, to vote as a majority of the Labour Party may decide at a duly constituted caucus meeting.

At the elections of 1895 19 labour members were returned, and held the balance of power; George Reid, then premier, took care to adapt his policy as much as possible to their predilections, carrying out public works by day labour, and passing land and income taxes, a franchise extension act that gave the suffrage to the police, a workshops and factories act, and a coal-mines regulation act.

The elections of 1898 strengthened the labour position, since Reid's followers were much reduced in number. In September 1899 the party —which had long since adopted the policy of supporting on non-labour policies the party that would concede most to labour's policy—ejected Reid and transferred its support to W. J. Lyne, who during his term of office (1899-1901) passed an early-closing act, an old age pensions act, a miners' accident relief act, and much similar legislation.

From 1901 onwards the federal parliament became the main scene of labour's advance, and Watson and Hughes, besides minor leaders, transferred their activities to that sphere. In New South Wales the party continually increased its strength, numbering in 1901 24 out of 125, in 1904 25 out of 90, in 1907 32 out of 90, and in 1910 becoming an absolute majority (46) of the legislature and attaining office under J. S. T. McGowen. The acceptance of woman suffrage and the development of the State arbitration system (for which see INDUSTRIAL LEGISLATION) were admittedly due to labour support. The party's greatest handicap was its lack of representatives in the legislative council, which is nominee; but Reid in 1899 nominated four labour councillors and Lyne in 1900 added two more.

In *Queensland* the first attempt to secure direct representation of labour was made in 1886, when W. M. Galloway stood at a by-election for Fortitude Valley and secured only 111 votes. At the elections of 1888 four labour candidates ran, but secured only 1261 votes between them; T. Glassey, however, who had been elected as a supporter of the Griffith ministry, left that party and declared himself a labour member, and was joined by J. P. Hoolan. In 1892 T. J. Ryan and G. J. Hall were elected on the labour platform, and these four formed the first distinct labour party in the house, Glassey acting as leader. The elections of May 1893 returned 16 labour members, among them Anderson Dawson, Andrew Fisher and Charles McDonald; and in March 1896 20 were returned out of a total of 72. In June 1898 the labour convention adopted a new platform. Candidates pledged themselves to support the principles contained in the platform, and, in the event of their not being selected, not to oppose the candidature of the duly selected nominee. The elections of March 1899 returned 23 labour members, and two bye-elections later in the year raised the party's strength to 25. When in November the Dickson ministry resigned, Anderson Dawson (q.v.) formed the first labour ministry known to the world. Dawson was premier and chief secretary, C. B. Fitzgerald attorney-general, Henry Turley home secretary, W. Kidston treasurer and postmaster-general, W. H. Browne minister for mines and public instruction, H. F. Hardacre minister for lands and agriculture, and Andrew Fisher minister for railways and public works. Being from the start in a hopeless minority, this ministry lasted only seven days.

After federation the Queensland legislature, like those of the other States, lost several of its best men to the Commonwealth parliament. When in September 1903 the Philp ministry resigned, a coalition was made between labour and the regular opposition, and Arthur Morgan, resigning the speakership, formed a ministry with W. H. Browne as minister for mines and W. Kidston as treasurer. At the elections of 1904 35 labour members were returned. In January 1906 Morgan resigned and Kidston became premier, but soon left the party; the coalition then disappeared, labour regained its independence, and Kidston found himself in a position similar to that of Reid in New South Wales in 1895-9. The elections of 1907 returned 18 labour members, who, as Kidston's followers were in a minority, held the balance of power; those of 1908 gave labour 23 representatives, who for the time supported Kidston, but at the elections of 1909 stood alone and increased their number by four. Kidston and Philp had meanwhile coalesced, and the labour party was now the official opposition. In 1912 it lost two seats, but in 1915 came into power with an overwhelming majority under T. J. Ryan (not the shearer of 1892), and entered on a career of 'advanced' legislation and administration that is still (1925) uninterrupted. This long tenure of power is partly accounted for by the abolition of the legislative council in 1922, and by the system of proxy voting in the single chamber that remains, whereby the leader of a party can vote the full strength of his party whether present in parliament or not.

The first labour member for *Victoria*, Charles Jardine Don, was elected for Collingwood in August 1859, worked as a stonemason all day, and attended parliament at night; in 1861 he lost the seat to Graham Berry by 46 votes only. In 1859 the diggers of Ballarat paid the expenses of Duncan Gillies, who afterwards voted as a conservative. In 1880 the general secretary of the Amalgamated Miners' Association was an unsuccessful candidate for Clunes and Creswick. In 1891 John Hancock, a leading trades-hall unionist, was elected for Collingwood by a big majority; this victory resulted in the creation of a labour political organization affecting the whole colony, known as the 'Progressive Political League.' The parliament of 1889 already contained two men who could be classed as pro-labour, W. Maloney and W. A. Trenwith; W. D. Beazley joined the movement, thus giving labour in 1891 a strength of four.

After the elections of 1892 it had 10 in a house of 90. William Shiels (q.v.), then premier, who advocated most of the Progressive League's measures, failed to carry them, and was displaced by J. B. Patterson; the financial crisis of 1893 discredited him, and in the elections of 1894 labour secured 16 seats. The Victorian labour party, however, has never prospered like those of other States; its high-water mark was reached in 1908 with 21 members out of 65. This comparative unsuccess is probably connected with the fact that nearly all Victorian labour members have been elected by metropolitan constituencies, the country districts holding aloof, so that the party has not been able to understand the requirements of the State as a whole. In 1908, for instance, 12 of the 21 members were metropolitan and five more represented goldfields; this proportion may be usefully compared with that of the New South Wales members in 1891. For some such reason the labour party has wielded less than its due

influence in Victorian politics, and has never held the balance of power, since the other parties have always been willing to combine against it.

In *South Australia* the first sign of labour interest in politics was the formation in January 1884 of the United Trades and Labour Council, which in 1887 secured the return of seven members and in 1890 of 14. None of these, however, could be classed as labour representatives —the only member so describable was G. M. Cotton, who was returned in 1888 to the legislative council. After the maritime strike of 1890 labour became more active. In January 1891 a meeting of executives of the unions and workers' clubs resolved to put forward direct representatives of labour. A platform was drawn up, a pledge adopted, and a subscription raised among the affiliated societies to pay expenses; three members were chosen to run for the legislative council, and all three were elected in the following May. This success encouraged the council in July to call for nominations of 15 candidates; voting for the 15 took place in the following February, and T. Price (q.v.), who came 16th on the list, was allowed to be included. At the 1892 elections eight of these candidates were elected, including E. L. Batchelor, W. O. Archibald and T. Price; these formed the first 'United Labour Party.' At the elections of 1896 11 labour members were returned, and by 1898 the party had also four members in the legislative council. Its isolation was not so complete as in other colonies, and in the Holder ministry of 1899-1901 Batchelor was minister of education and agriculture. Both Holder and Batchelor resigned in 1901 to enter the federal parliament, and for a few years labour in the State was under a cloud; but in 1905 the tide turned, 15 labour members were returned, and coalesced with the 'liberals' under A. H. Peake. On 26 May a coalition ministry was formed, with T. Price as premier. Government bills being rejected by the legislative council in 1905 and 1906, Price went to the country, and the labour party returned with 19 members; in 1908 the number was raised to 20, in a house of 42. Price taking the agent-generalship, A. H. Peake (the 'liberal' leader) succeeded him, and in 1909 broke up the coalition and joined his former antagonist Richard Butler; but at the next elections (1910) labour won 22 seats, Peake resigned, and a wholly labour ministry was formed under John Verran. In February 1912 the Verran ministry was defeated, and the number of labour members fell to 16; the Peake-Butler coalition returned to power, and labour went into opposition for 12 years.

In *Western Australia*, where self-government was established in 1890, the discovery of gold brought a rush of miners from the eastern colonies. A Trades and Labour Council was formed in Fremantle on 9 December 1892, and a platform adopted, including electoral reform, manhood suffrage, and an eight-hour day. In May 1897 C. H. Oldham was elected as a labour representative, although members were not yet paid. Early in 1899 Hugh de Largie, president of the Australian Workers' Association, suggested the summoning of a trade union and labour congress; the meeting was held in Coolgardie in April, political action was decided upon, and a fighting platform adopted, including payment of members, redistribution of seats on a proportional basis, and compulsory conciliation and arbitration on New Zealand lines. Federation was also approved of. At the State elections of 1901 a party of six was returned, which in 1904 with a more liberal franchise grew to 21 out of a total of 50 members. Five independent members joined labour in expelling the James ministry, and a labour ministry was formed under Henry Daglish. He resigned, however, in August 1905, and the labour party lost ground at the elections. Twenty-two members were returned at the elections on 11 September 1908, but one member was unseated on appeal and lost at the fresh election. In 1908, however, the party came back 22 strong, and in October 1911 gained a complete victory, defeating the government that had been in power for six years and obtaining 34 votes to the opposition's 16. John Scaddan at once formed a purely labour ministry (that of Daglish had included independent members) and held office until August 1915.

In *Tasmania* labour made its first move in 1893, and in the following year Allen McDonald was returned for Launceston. Leagues with attractive names were formed in Hobart and Launceston, but by July 1896 were all absorbed into the 'Democratic League of Tasmania.' No political successes, however, were obtained until the elections of 1903, when three labour members were returned out of a total of 35. At the elections of 1906 this number was increased to seven. The parliament of 1906-9 altered the constitution, reducing the numbers of the legislative council to 18 and of the assembly to 30, and in the 1909 elections labour secured 12 seats out of the 30. The Lewis ministry being defeated on a vote of censure, John Earle formed the first labour ministry, but could not attract sufficient outside support to give him a majority, and Lewis came back to office. The elections of 1912 sent 14 labour members to parliament.

Labour in Federal Politics.—Since the inauguration of the Commonwealth labour members have played an important part in federal politics, mainly because the party for 15 years chose its best men to represent it there. In the first parliament there were eight labour senators out of a total of 36, and 16 representatives out of 75; these included W. G. Higgs from Queensland, G. F. Pearce from Western Australia and G. McGregor from South Australia among the senators, and among the representatives J. C. Watson, W. M. Hughes, W. G. Spence (all from New South Wales), Andrew Fisher, C. McDonald and J. Page (Queensland) and E. L. Batchelor from South Australia. J. C. Watson was chosen leader.

At the elections of December 1903, 14 labour senators and 25 representatives were returned; and, when the Deakin ministry resigned in April 1904, J. C. Watson formed the first Commonwealth labour ministry, as follows:—prime minister and treasurer, J. C. Watson; attorney-general, H. B. Higgins; minister for trade and customs, A. Fisher; minister for external affairs, W. M. Hughes; postmaster-general, H. MacMahon; minister for defence, A. Dawson; minister for home affairs, E. L. Batchelor; vice-president of the executive council, G. McGregor. H. B. Higgins was not actually a labour member, but was in sympathy with the ministry's policy. This ministry was defeated in August by a coalition of the parties led by Deakin and Reid: but, when in the following June this coalition went to pieces, the labour party supported Deakin wholeheartedly for two years. In December 1906, 27 labour members were returned to the house of representatives and 15

to the senate. In 1907 the party lost its leader, J. C. Watson; his place was taken by Andrew Fisher, who in November 1908 formally withdrew the party's support from Deakin, and on the 17th formed a ministry of his own, with the qualified support of the Deakin party. In May 1909 Deakin in his turn withdrew this support, coalesced with the former opposition led by Joseph Cook, and formed a new administration that saw the parliament out.

In April 1910, however, labour secured an unmistakable victory, sending 42 members to the house of representatives and winning all the 18 vacant seats in the senate. On 29 April Andrew Fisher formed his second ministry, the first labour ministry with a substantial majority behind it; and the legislation of 1910-13 embodied many of the party's most cherished ideals, including land taxation, the establishment of a Commonwealth Bank, the enlargement of the old age pensions scheme and of the scope of federal arbitration, and acts providing for workmen's compensation and a maternity allowance.

Lacewings. See PLANIPENNIA.

Lachnostachys, a genus of the family Verbenaceae, endemic in Western Australia. The calyx is broadly bell-shaped, with 5 to 8 lobes, densely woolly; corolla shorter than the calyx, truncate or shortly and equally 5-8-lobed; stamens 5-8, protruding, inserted on the margin of the corolla or between its lobes; fruit hard, usually one-seeded and enclosed in the calyx; leaves opposite, undivided. In several species the flowers are concealed in a dense cottony woolly mass, which has given rise to the name 'blanket-plants.'

Ladybirds. Great interest attaches to the Australian members of this group, as efforts, in some cases successful, have been made to introduce many of them to other parts of the world, in order to check certain destructive insects. With few exceptions the species feed on scale-insects, aphides, and other small homopterous insects, some of which are very troublesome to fruit-growers. One of the most useful species is *Leis conformis* (bright yellow, with numerous round black spots); a colony of these ladybirds appearing on a rose or other bush affected by aphides will in a few days completely free it. Orange, apple, and other fruit-trees—especially the peach—benefit from their work. All attempts to acclimatize them in California, South Africa, England, and India have failed, though in several instances many thousands of specimens have been landed alive in those countries. The typical form does not occur naturally in Western Australia, its place there being taken by a smaller species, *Cheilomenes quadriplagiata*. Another yellow-and-black species, *Coccinella transversalis*, occurs in Australia (all States), the Malay Archipelago, etc.; it feeds on similar insects, but its larvae are attacked by so many kinds of parasites that the species seldom gets a chance to multiply as abundantly as is desirable. The beautiful blue-and-yellow ladybirds of the genus *Orcus* feed almost solely upon scale-insects; in New South Wales and Queensland several species occur in abundance upon orange-trees attacked by the red and white scales. A small species, *O. chalybeus*, is perhaps the most useful; but, despite repeated attempts to multiply it in California, it appears barely able to maintain itself there, nor does it appear able to live in the comparatively dry orange-growing districts of South and Western Australia. *O. lafertei* and *O. coelestis* are useful in tropical Australia; *O. australasiae* is the most widely distributed species, but is seldom found in orchards.

The most noted Australian ladybird is a small red-and-black one, *Novius cardinalis*, that feeds almost solely upon the cottony-cushion scale-insect (*Icerya purchasi*); although widely distributed in Australia, it was almost unknown till its introduction to the United States, where in a brief period it almost entirely freed the orange-groves of California from that scale, which previously had threatened their destruction. It has also been successfully introduced into South Africa, Egypt, Spain, and Italy. The success obtained with this species was so pronounced as to rouse hopes that most of the destructive insects of the world could be controlled by introducing other insects to feed upon them; as the estimated damages due to insects have been put down at one-tenth of all the crops produced, the saving in this way would amount to many millions of pounds annually. Hundreds of species of ladybirds and other insects have since been introduced to various countries, but very few of these have proved of much use, as climatic conditions, parasites and (in some cases) birds have prevented them from increasing to useful proportions. Parasites useful against the codling moth have also been persistently sought, with, as yet, very little permanent benefit.

A small black-and-yellow hairy species, *Cryptolaemus montrouzieri*, which feeds largely upon mealy-bugs, has been successfully introduced into Hawaii and California; a few specimens placed in a glass-house for plants will soon free it from mealy-bugs. A small black hairy species with red abdomen, *Rhizobius ventralis*, feeds upon many kinds of scale-insects. After its introduction to the United States it multiplied greatly, and proved to be of much use for some years, but is now regarded as of secondary importance; largely owing to this species, and to others of its genus, the San Jose scale (*Aspidiotus perniciosus*) did not become as troublesome in Australia as at one time it threatened to be. The small hairy species of *Scymnus*, abundant everywhere in Australia, feed largely on scale-insects; but a very small species, *Scymnus vagans*, feeds upon red spider (*Tetranychus telarius*), red mite (*Bryobia pratensis*) and other minute pests. *Scymnus notescens*, one of the few species with distinctive elytral markings, feeds on aphides, and may be seen in abundance on cucurbitaceous plants affected by such insects. The species of the sub-family Epilachnidea are all plant-feeders; but only one, *Epilachna 28-punctata*, is a serious pest in Australia—it extends over the eastern and northern parts and is destructive to the potato, tomato, and other solanaceous plants, as well as to the pumpkin and its allies. Unfortunately it very closely resembles one of our most useful species, *Leis conformis*, and the latter in consequence often suffers at the hands of growers, who ignorantly destroy one of their best friends. A second species, *E. guttatopustulata*, attacks similar plants, but is much less abundant.

A. M. L.

Lalor, PETER (1827-1889), born at Tinakill in Queen's County, Ireland, on 5 February 1827, and educated at Trinity College, Dublin, adopted the profession of civil engineer and in 1852 sailed for the goldfields of Victoria, where he first sampled the Ovens diggings and then worked a claim at Ballarat on the Eureka lead.

Just as this claim was developing riches, the unrest among the miners in October-December 1854, always associated with the Eureka Stockade (q.v.), drew Lalor away from work and absorbed him in the business of the Ballarat Reform League. On 30 November he was chosen leader of the rebels, and did his best to organize a fighting force; but when on 3 December the stockade was stormed he was wounded in the shoulder and carried to safety by a few friends. Proclaimed an outlaw, he remained hidden in Geelong until the trials of other rebels proved abortive; then he returned to Ballarat, and in November 1855 was elected to the legislative council by his digger friends. The next year he was chosen by South Grant—a constituency that included Ballarat West—to represent it in the new legislative assembly, and held the seat until 1871, being chairman of committees from 1859 to 1868. From 1868 to 1874 he devoted most of his time to developing Clunes. In 1871 he lost his seat, but regained it in 1875, and joined Graham Berry's first ministry as commissioner of trade and customs (August-October 1875), holding the same office in Berry's second ministry (1877-80); in this he was also postmaster-general for about six weeks (May-July 1877). On 22 July 1880, mainly as a challenge to Berry's enemy, James Service, Lalor was elected speaker; in this position he behaved with unexpected firmness and impartiality for seven years, but severe illness forced him to resign on 29 September 1887. Parliament granted him £4000 for past services, but he did not live long to enjoy it, dying at Melbourne on 9 February 1889.

Lambert, GEORGE WASHINGTON, born at St. Petersburg in September 1873 and for a short time educated privately in England, was brought by his grand-parents to Sydney in 1883 and, after a short but vitally important visit to the Nevertire district of New South Wales (where he saw and was absorbed by the Australian bush), worked for four years as a clerk in Sydney. A second visit to the bush (during which he worked as a station hand), and the encouragement of B. E. Minns, prompted him to join the art school of Julian Ashton (q.v.), where he soon distinguished himself by selling pictures to the Sydney art gallery. In 1899 he became notable as the painter of 'Across the Blacksoil Plains,' still one of the best-known and most generally admired Australian paintings, which is hung in the Sydney gallery. Winning a scholarship offered by the Society of Artists (see ART) which provided funds for three years' study in Europe, he left Sydney in 1900, studied for a time at Colarossi's studio in Paris, and then settled down in London to do black-and-white work for the *Strand* and *Pall Mall* and to make a serious study of portrait-painting. In 1903, and in each year from 1905 to 1911, portraits or groups of his were hung (usually on the line) at the Royal Academy and by 1911 he was among the few recognized portraitists of the first class: he was a foundation member of the Modern Society of Portrait Painters, a member of the International Society of Sculptors, Painters and Gravers, and an associate of the New Salon in Paris. Among his portraits of this period are those of Sir George Reid (in the federal parliament-house at Melbourne), the Gaekwar of Baroda, Lady Beaverbrook and Cunninghame Graham. His reputation now spread beyond London and Paris, and 'The Mask,' his Academy picture in 1911, was exhibited in Venice and bought there for a gallery in St. Petersburg. During the war he served as works officer of the British timber supplies department (1915-7) and official artist with the Australian light horse in Palestine (1917-8): in 1919, being commissioned by the Australian war museum to paint records of the landing on Gallipoli, the light horse charge at the Neck, the Beersheba charge, and other great deeds of the war, he accompanied the official war correspondent in a tour of Gallipoli and Palestine to acquire a thorough knowledge of the scenes he had to depict, and in 1921 came back to Australia to complete his pictures among the men they concerned. In 1922 he was elected an associate of the Royal Academy.

See *The Art of George W. Lambert, A.R.A.* (Sydney, 1924), which includes a careful study of his methods and aims as a painter. W.M.

Lambertia, a genus of the family Proteaceae, endemic in Australia, consisting of shrubs with leaves usually in whorls of 3. The flowers are red or yellow, 7 together within a circle of imbricate, coloured bracts; corolla regular, the tube elongated, surmounted by narrow, spirally revolute lobes; anthers inserted on the lobes and revolute with them; fruit a short, hard, truncate follicle with 2 valves, the lower margin of each valve produced into a thick horn; seeds flat, bordered by a narrow margin. Most of the species are confined to Western Australia; the only eastern representative is the Honey Flower (*L. formosa*)

Honey Flower.

which has acquired its popular name from the large quantity of honey in the flowers. It is confined to the coastal sandstones of New South Wales, extending as far south as Braidwood.

Lamington, BARON. Charles Wallace Alexander Napier Ross Cochrane-Baillie, 2nd baron Lamington, born on 29 July 1860 and educated at Eton and Christ Church, Oxford (B.A., 1881), was in 1885-6 assistant private-secretary to Lord Salisbury (then prime minis-

ter) and represented North St. Pancras in the house of commons from 1886 to 1890. Succeeding his father in that year, he travelled through Siam and Tonquin for nearly two years, and on 9 October 1895 was appointed governor of Queensland, assuming office on 9 April 1896. During his term of office he travelled a great deal in Queensland and New Guinea. He left office on 19 December 1901, returned to England, and from 1903 to 1907 was governor of Bombay. (G.C.M.G., 1900; G.C.I.E., 1903.)

Land Legislation, Tenure, and Taxation. The development of land legislation in Australia has been influenced by the character of the early settlement, steadily widening knowledge of the extent and resources of the continent, growth of the population, improvements in internal and overseas transit facilities, the development of agricultural science, and the consequent increase in the number of uses to which the soil might be put. Along with these purely economic factors others of a political character have played a part, especially (*a*) the rise of a Labour party, hostile to the further alienation of land, and to the existence of the large landowner; (*b*) the influence of prolonged and intensive propaganda by followers of Henry George; and (*c*) the general acceptance of the doctrine that the best line of social progress results in the close settlement of rural areas by a nation of industrious and sturdy yeomen.

A detailed survey of the extremely complicated history of land legislation and administration in each State is here impossible. Most legislation has been of an experimental nature, and later experience has soon made amendments necessary; almost every session of every colonial or State parliament has witnessed the passage of new land laws, and the position has consequently become at times very confused, in spite of attempts at simplification and consolidation. Still, the general trend of theory and practice can be stated in broad outline under four periods.

Period of free grants (1788-1831).—The early governors had power to make grants of land to suitable persons, whether free settlers or emancipists. At first only small blocks were alienated; but with the advent of the pastoral industry, the abandonment of all attempts to confine settlement to the Sydney area, and the realization of the vast expanse available for settlement, large holdings were permitted. Officers and officials helped themselves to big blocks; the British government granted 1,000,000 acres to the Australian Agricultural Company, 350,000 to the Van Diemen's Land Company, and 250,000 to the promoters of the Swan River settlement in 1829. By 1831 probably 4,000,000 acres had been given away; much of it was in large or very large holdings, and in most instances the prescribed small quit-rent was not being paid.

Period of land-sales and pastoral leases (1831-1851).—In 1825 the sale of land began. At first private tenders were called for, the minimum being fixed at 5s. per acre, and lands in eastern New South Wales were valued by a commission to fix prices for future sales. In 1831 free grants were abolished, and sale by auction was introduced. The upset price, 5s. an acre, was raised to 12s. in 1839, and to £1 in 1842. An imperial act of 1842 decreed that half the proceeds of land-sales was to be spent in assisting immigration. British policy at this time was largely influenced by the ideas of Edward Gibbon Wakefield (q.v.), who was urging that land be sold at a 'sufficient price,' and the revenue thus raised be devoted to public works and the immigration of agricultural labourers. The price would be so high that it would be impossible for the assisted immigrants to desert their jobs and buy land until they had worked some years in the colony, so that settlement, public works, and labour supply would progress *pari passu*. South Australia was founded on lines inspired by Wakefield; but for various reasons, of which one of the chief was a wave of land speculation, the original scheme failed and had to be discarded. When self-government came, most of the colonies regarded land-sales receipts as general revenue, and used only a small and fluctuating part for immigration; the rest went to defray general expenditure.

Usually land was not sold until it had been surveyed, but the growth of the sheep industry made necessary the framing of a policy for dealing with large outback areas, unsettled and unsurveyed, on which flocks of sheep were (technically) trespassing. Until 1846 the owners of such flocks, known as 'squatters,' had to obtain annual licences, and efforts were made to forbid unlicensed grazing; but the position was unsatisfactory to all parties—the licensee, having no fixed boundaries and no security of tenure, would not erect decent buildings or fences, and the authorities had the thankless task of trying to police the pastoral areas. In 1847, after a ten years' struggle, the pastoralists secured from the British government orders in council that established a new system of tenure. Land was to be divided into three districts—settled, intermediate, and unsettled. In the settled district pastoral leases for one year were allowed; in the intermediate area the tenure was extended to eight years, and in the unsettled lands to 14 years. During the currency of the lease (except in the intermediate area) the holder could not be disturbed by any buyer; he could purchase any portion of his holding at any time at £1 an acre, and on the expiration of his lease had a pre-emptive right to all or any part of his land. For the intermediate area a unique form of lease was devised; although the nominal term of it might be anything up to eight years, yet at the end of any year it might be cancelled on 60 days' notice and the land sold over the lessee's head.

These orders, by giving the pastoralist security of tenure and the first right to buy any part of his holding, were a great boon to the wool industry. Lessees at once began to make improvements on their stations and increase the efficiency of their work. But, while security of tenure was justifiable, the pre-emptive right roused much hostility from governors and the public; for the lessee not merely bought up the 'eyes' of his holding, and thus rendered the rest of it useless to anyone but himself, but also secured this freehold at £1 an acre, which was often far below the price it would have brought if sold by auction. So keen was the opposition to these concessions, especially in Victoria, that the governor of that colony virtually refused to put the orders into force. In New South Wales, however, the governor acted upon them, and the lessees benefited considerably thereby.

Period of selection before survey (1861-1890).—After 1850 the whole character of the land problem changed. Self-government was granted to all the colonies except Western Australia, and land tenure became a matter of local legislation. The gold-rush brought a large addition to the population, and when the rush subsided many ex-diggers and other immigrants wished to

settle on the land. Some had found fortunes on the goldfields; but it is probable that most of them had only a small capital, would be unable to pay cash in full for farms, and required small holdings, suitable for agriculture. To help such men to find land, and thus build up a race of 'sturdy yeomen' side by side with the pastoralists, was therefore the guiding principle of land legislation from 1860 onwards.

The outstanding effort to foster the settlement of small farmers in New South Wales was Robertson's scheme for 'free selection before survey' (1861). It contained two important new points: (*a*) pastoral leases were granted for one year if within the 'settled' districts, or five years if outside, but the whole leasehold area, surveyed or not, was open to selection and sale at any time; (*b*) selectors could pick a limited area (40 to 320 acres) in any place, at £1 an acre, and pay as deposit one quarter of the purchase-price—they must then reside on the land for three years, make improvements worth £1 an acre, and pay off the balance of the purchase money virtually at will, with 5 per cent interest.

This plan—'conditional' purchase by residence, by improvements, and instalments—was destined to play a large part in the subsequent history of land-settlement. The underlying principle was copied by almost every colony sooner or later, e.g. in Duffy's legislation in Victoria (1862), and in Strangways's act of 1869, which introduced purchase by instalments to South Australia. Much was expected of it; and it has established some small farmers on the land, especially since 1890, when it was developed and surrounded with safeguards against abuse. But its chief and first effect was to precipitate a fierce struggle between the squatter and the invading selector, especially in New South Wales. Some selectors really wished to take up land for farming; others were little better than rogues. The latter picked a selection on a sheep-run, not in order to cultivate it, but in order to compel the harassed leaseholder to buy them out at a high price. Whether the selector was a settler or a speculator, he was unwelcome to the squatter, who therefore set to work to defend his run from invasion by buying up the 'eyes,' and as much besides as he could afford. He sought the aid of the banks in buying land, and employed 'dummies' to take up selections on his behalf; he even sometimes went so far as to obtain paupers from the asylums and put them on allotments. He bought heavily at auction sales when any part of his holding was put up for sale, and, as he could usually pay cash or offer to buy large tracts, he beat the smaller men in the auction room. In short, by adopting as a defence offensive methods that were 'sometimes ingenious and sometimes dependent for success on barefaced perjury' (Coghlan), the big leaseholders emerged from the struggle big freeholders. The legislation that had been intended to settle eastern Australia with industrious yeomen handed a great area of it over to big landowners. In New South. Wales, between 1861 and 1884, more than 39,000,000 acres were disposed of in one way or another—over half of the area by conditional purchase; yet this vast alienation gave the colony only 21,000 more settlers, and only 420,000 acres more were under the plough in 1884 than in 1861. In Victoria similar developments took place during the same period, while in South Australia in 1891 539 persons held two-fifths of the alienated area in estates of over 5000 acres. Much of the land in the big holdings was inside the area suitable for agriculture, and was well supplied with roads and rail-facilities; only 50 miles from Adelaide, for instance, there was an estate of 70,000 acres freehold, with good rich soil and a 20-inch rainfall. Similar cases could be quoted in all the colonies.

Period of experiment and reform (1890 onwards).—By the later eighties it was generally recognized that the whole land problem must be reconsidered. Thanks to irrigation and improvements in refrigerative processes, new avenues of production were being opened up. Refrigeration alone meant that Australia could develop an export trade in perishable commodities, such as meat, butter, and fruit; hence grazing, dairy work, and orcharding entered upon a new phase of growth, bidding for a world-market. Meanwhile the use of superphosphates and of dry-farming methods was turning into possible wheat-fields large belts of the low rainfall area, especially in the mallee country of Victoria and South Australia. Henry George's visit stimulated a widespread discussion of land problems, and the Labour party was soon to make its influence felt. Public men were realizing that Australia must carry a much larger population to defend the continent as well as to develop it; but immigrants could not be welcomed unless there was suitable land on which to settle them.

Since the later eighties, therefore, and especially since Australia's recovery from the depression of the early nineties, new or amended land-laws have been devised, having as their object (1) the settlement of a rural population on holdings which, if properly used, are not too large to be fully worked or too small to provide a comfortable family living; (2) the utilization of the soil to the best purpose for which it is fitted; (3) the breaking-up of large pastoral estates suitable for closer settlement and cultivation; (4) the assistance of rural producers, especially small holders, by the provision of water supply, credit facilities, produce depots, etc. All this intensified activity has made necessary the provision of adequate administrative machinery, and in each State a lands department controls all matters relating to crown lands; it is often assisted by decentralized local land boards, and special bodies to deal with such matters as irrigation, closer settlement, or advances to settlers. The departments are faced by two outstanding problems. On the one hand further alienations of land must be watched to prevent a repetition of the blunders made in the past. How big this task is will be realized from the table given on next page.

Thus, during less than 20 years State departments have leased or sold an area equal to about three-eighths of the total area dealt with during the whole of the nineteenth century; in two decades, indeed, they have alienated or put into process of alienation about half as much land as in the whole previous period of settlement. On the other hand governments have endeavoured to undo the past (*a*) by repurchasing big estates for subdivision into small farms, (*b*) by taxing the big owner in order to drive him into better use of his land, or into the market. There are thus three main strands in recent land policy —more careful alienation, resumption for closer settlement, and land taxation.

Alienation.—Most of the land likely to be settled in the near future has been surveyed, and classified according to situation, character of soil or sub-soil, climatic conditions, extent of timber, etc. This classification vitally affects

	In 1901.	In 1920.	During Period 1901–1920.
	acres.	acres.	acres.
Area alienated	76,000,000	109,000,000	33,000,000
Area in process of alienation	35,000,000	57,000,000	22,000,000
Held under lease or licence	721,000,000	974,000,000	253,000,000
Total	832,000,000	1,140,000,000	308,000,000

the mode of tenure under which land may be allotted, the area of the holding, the use to which it may be put, the price or rent, the length of lease, the conditions as to residence, improvement, and payment of purchase instalments, the liability to invasion for settlement or resumption, and so forth. Further, the tenures are devised to fit the circumstances of the land-seeker. They are grouped in six main classes: (1) free grants, reservations and dedications; (2) sales by auction and special sales; (3) conditional purchases; (4) leases and licences; (5) closer settlement sales, leases, and licences, and (6) mining leases and licences.

The subdivisions in these classes are often great. New South Wales has 19 different types of lease in class 4, each to suit some special kind of land or tenant; Victoria has seven kinds of conditional purchase; and in all New South Wales has 36 different methods of dealing with land.

Of the various tenures one or two call for comment. Free grants, except for public or special purposes, are very rare. Queensland and Western Australia have offered free homesteads, subject only to residential and improvement conditions, but the results have not been very satisfactory. Sales by auction still survive in most States. But the popular method of alienation is conditional purchase, the conditions consisting usually of an initial deposit, a certain period of residence during the early years, improvements of a certain value, and the payment of the balance of the purchase money over a period of 30 years or more. Leases are granted especially for regions that at present are fit only for pastoral or mining work. The holding varies in size according to the character and location of the leasehold, and in districts of very low rainfall may run to hundreds of square miles. These leases are often for a long term, say 21 or 42 years; sometimes the rent is subject to re-assessment every 5 or 7 years. But leasehold tenure has in some States been used as a substitute for freehold. The Labour party opposes all further alienation of crown lands; it therefore stopped the further granting of freehold in the Northern Territory in 1912, and in Queensland in 1916. Henceforth land was to be leased only, either for a period in the case of large pastoral holdings, or in perpetuity when smaller areas of arable or dairy land were concerned. The perpetual lease, with periodic re-assessment of rent, satisfied in part the demands of advocates of land nationalization and of land taxation, for it kept the land in the hands of the State and allowed the community to annex some share of the unearned increment by revision of rents. Hence in some States perpetual leasehold tenure goes back as far as the eighties. But needy treasurers miss the revenue which would come from land-sales, and most perpetual lessees, especially on small homestead farms, long to secure the fee simple. Hence it is probable that the refusal to sell crown lands will hold only when and where Labour is the dominant influence.

Resumption for closer settlement.—The repurchase of estates is associated with (*a*) irrigation schemes, (*b*) the conversion of large pastoral freeholds into small dairy, grazing, wheat, or orchard blocks, (*c*) the settlement of returned soldiers. All States have passed legislation authorizing the government to buy estates to be cut up into blocks of suitable size, which are sold or let to settlers on easy terms. Usually settlers can obtain advances from the government with which to build homes or make improvements; and, where the land needs to be irrigated, the constructional work and the supply of water is undertaken by the State in return for a rent of so much per acre. This policy was inaugurated about 1900, and power to purchase land compulsorily has been granted in all States except Western Australia. The progress of resumption has been slow. By June 1923 4,150,000 acres had been purchased at a cost of £16,000,000 and 14,250 settlers had been established thereon. Some settlements have been successful; others after a hard struggle have ended in failure. Heavy initial costs, unsuitable land, and inexperienced workers have been among the causes of non-success. As part of the repatriation plans over 6,250,000 acres had by June 1923 been purchased or set aside out of crown lands for returned soldiers, at a cost of £28,000,000 and about 23,000 soldiers' farms had been allotted. Though it is still too early to estimate the results of this experiment, it is already evident that certain factors are militating against successful work, e.g. the character, inexperience, and lack of aptitude of some of the settlers, the high prices paid for some lands, the heavy costs of construction in irrigation centres, and the difficulty of finding markets. Most of the land was bought during a period of boom prices; material for construction was secured largely during the high-price period of 1918-1920. Hence the task of meeting interest and capital repayments may prove too heavy in a period of lower prices, and it may be necessary for governments to write down the value of the properties.

Land Taxation.—In spite of all efforts to build up a rural population, progress between 1890 and 1910 was slow. In 1911 New South Wales had 5000 more agriculturists, Victoria 1000 more, and Queensland 200 fewer, than in 1891. Between 1901 and 1911 the population of the continent grew by 18 per cent; the number of those engaged in pastoral pursuits rose by 36 per cent, but the number of agriculturists by only 4 per cent. The net immigration during the first 10 years of the century was only 40,000. Large estates grew in number, and in 1910 there were 1152 freehold estates of over 10,000 acres, with a total area of 30,600,000 acres; that is, 29 per cent of the land was owned in holdings of one acre or over.

To break up these large holdings, or to bring them into better use, was the aim of the federal land tax, imposed in 1910. Taxation of the unimproved value of land began in South Australia in 1884, and other colonies imposed the tax later

(New South Wales in 1895, Western Australia in 1907, Tasmania and Victoria in 1910, and Queensland in 1915). Local authorities had also been given power to levy rates on the same basis, so that with the coming of the federal tax three levies might be made on the same thing. The State taxes were mostly small (½d. to 1½d. in the £), but the federal tax was much more severe. Residents were exempted from taxation for the first £5000 of unimproved value; absentees had no exemption. The rate of tax ranged from 1d. up to 6d. (the rate on unimproved values exceeding £80,000), with an extra penny on the land of absentees. In 1914 the tax was extended from freeholds to leaseholds, and in 1914 and 1918 the rate was increased to raise more revenue for the war. Hence a Queensland estate worth £200,000 unimproved value paid in 1919 about £10,500 in State and federal land tax; a South Australian estate of the same value paid £6900. Quite apart from local rates, large estates might be paying an annual capital levy of 3 to 5 per cent on the unimproved value of the property.

The federal land tax has achieved part of its purpose in breaking up very large holdings; at the same time it has provoked a battle of wits between the taxpayer and the taxgatherer. It has led to much costly litigation on matters of interpretation and valuation, and many large owners have evaded the full weight of the tax by dividing their property among the members of their family, while really keeping the control still in their own hands. Where estates have been sold, the price obtained has usually been satisfactory to the vendor, but those who declined to sell have been able to meet the heavy taxation because of the good prices ruling (especially for wool) since 1914. Between 1910 and 1918 land with a total unimproved value of £63,000,000 (about one quarter of the land originally subject to tax) passed out of the taxable field into estates worth less than £5000 unimproved value. How much of this movement was due to family transfers, made in order to avoid taxation, cannot be ascertained, but certainly much land was affected in that way. Many large holders disposed of large tracts; in fact, during those eight years owners of estates in the class worth over £50,000 unimproved value got rid of land worth £28,000,000 unimproved value, and bought only £5,000,000 unimproved value. Absentee owners reduced their holdings by about half, and many resident smaller owners seem to have taken steps to put themselves below the tax-line. Between 1910 and 1920 the number of estates of over 20,000 acres fell from 431 to 349; the number between 5000 and 20,000 acres rose from 1592 to 2114, and the number between 500 and 5000 acres rose from 32,657 to 45,763. The very large holdings are steadily disappearing; the medium and large estates hold their own, or increase; the smaller ones increase rapidly. These figures do not, however, indicate fully what is happening. There are two contrary movements. On the one hand small men sell out to neighbours who are keen on acquiring larger holdings, possibly in order to turn arable into pasture land; often the blocks thus sold have been obtained by the vendor on conditional purchase, from crown lands or resumed and subdivided estates. On the other hand, very large holders may divide up their estates either among their children or among share-farmers, or may sell them outright to the government for closer settlement. Thus while land alienated in small blocks is being swallowed up in new large estates, older properties are being cut up for men who may eventually sell them to a new would-be large owner.

The attractions, economic and social, of city life draw rural dwellers away from the country. Retired farmers settle in the suburbs of the metropolis, the young folk flock to its shops, factories, and offices, and the countryside fails to retain its natural increase of population. To check this flow, by building up rural industries and by enhancing the social attractions of country life, is one of the big problems confronting the nation to-day. Again, settlement has, in the older States of the south-east, reached the limits of land suitable for cheap extensive exploitation. Western Australia and Queensland have still large areas of crown land suitable for selection; elsewhere further progress depends upon the closer settlement and more intensive cultivation of lands already in use, and the expenditure of large capital sums on roads, railways, and water conservation schemes to make semi-arid areas 'safe' for the small man. New South Wales discovered in 1923 that she must spend nearly £20,000,000 to settle 6000 new farmers; Victoria and South Australia can find room only by large resumptions. Thus Australia must either turn to its semi-tropical and tropical regions for areas on which to place fresh population, or must adopt and extend intensive treatment of those more fertile areas in the south which are already in private hands.

For a detailed account of contemporary legislation, application should be made to the crown lands departments of each State for copies of land laws in force, and explanatory pamphlets. See also the annual *Reports* of these departments. A more general survey will be found in the current issue of the Commonwealth *Year Book*. For a historical survey see Sir T. A. Coghlan's *Labour and Industry in Australia*; Nos. ii and iv of the Commonwealth *Year Books*; *Australia, Economic and Political Studies* (edited by M. Atkinson); Collier's *Pastoral Age in Australasia*; R. C. Mills's *Colonization of Australia*; and S. H. Roberts's *History of Australian Land Settlement*. For land taxation, see the annual *Reports* of the federal commissioner of taxation, and the fourth *Report* of the federal royal commission on taxation (1923).

H. He.

Land Planarians, a group of Turbellaria (see FLAT-WORMS), whose habitat is defined by their name. In other countries planarians are usually dealt with as a whole—many genera inhabiting fresh or salt water—but the abundance and variety of the land-inhabiting genera found in Australia justifies separate treatment in this case. Nowhere else can more species, or more individuals, be found; it is probably because of their softness, and the consequent difficulty of handling and preserving them, that they have attracted the attention of so few naturalists. The mere finding them is easy; they occur in gardens and parks, in bush clearings and uncleared scrub, wherever a little cover is available.

Each of the Australian States possesses a number of endemic species. In Victoria the magnificent *Geoplana spenceri*; in Western Australia *G. fusco-dorsalis* and *G. arenicola*; in New South Wales *G. quinquelineata* and *G. ponderosa*; in Queensland *G. regina, G. parva* and *G. scaphoidea*; in Tasmania the classic *G. tasmaniana* (originally collected and described by Darwin), *G. typhlops, G. dovei, G. lyra,* and others; are peculiar to these States, and have not been found elsewhere. In general character the Tasmanian species resemble those of Victoria more than those of the other States; the planarians of New

(1) *Geoplana ponderosa.* (2) *G. Mortoni.* (3) *G. Hillii.* Below each is its cross-section.

Zealand are of a type quite distinct from the Australian species.

In Australia land planarians are found chiefly under logs and pieces of wood that may be lying about in paddocks adjacent to scrub. In the scrub itself they are not so readily found, because of the larger amount of available shelter, and because the insects on which they prey are more abundant under logs in the open. Like other creatures of similar habit, they occur most plentifully where the soil is rich and moist. During wet weather they are to be met with under leaves, and even crawling about in the open daylight. Some species burrow freely, and seem quite at home in the soil associated with earthworms. For the most part they are carnivorous, feeding upon a great variety of insects, and even on molluscs and earthworms, while occasionally some species will devour others. Several different species, however, both of *Geoplana* and *Rhynchodemus*, have been observed feeding on peaches, strawberries, apples, and other fruits, and on bran that had been laid as a trap for slugs. Their method of securing their prey is to crawl over it, and thus entangle it with a sticky mucus freely secreted from the surface of their bodies. The trumpet-like suctorial tube is then protruded from the peripharyngeal aperture and inserted into the captive's body, and the soft parts of the latter are quickly transferred to the alimentary canal of the planarian. The peripharyngeal aperture is usually situated about midway on the ventral surface, and the genital aperture about midway between this and the posterior end.

In land planarians that have more than two eyes these organs are usually very numerous, amounting in some cases to several hundred. They consist of minute black dots, scarcely visible to the naked eye, extending in a single row round the edge of the anterior tip, usually expanding into a more or less crowded group on each side just behind the anterior tip, and then thinning out to a single row on either side which may extend to the posterior end. In some species there is little or no side-grouping, the eyes being arranged in a single row extending backwards to a variable distance. Planarians possessing two eyes only (*Rhynchodemus*) have them situated one on either side, just behind the anterior tip. The eyes appear to possess no true vision, but are merely sense-organs, allowing the animal to avoid the light when it so desires. When moving about they hold up the anterior end, curve the sides downwards so that a cross section would have the outline of a horseshoe, and delicately sweep the tip about, gently touching any object that may be in the way. Associated with the eyes are numerous minute ciliated pits which appear to have a sense analogous to that of smell.

Though nocturnal in their habits, land planarians move about in daylight during dull moist weather. They are hermaphrodite, the male and female organs opening into a common genital atrium. Specimens are frequently met with having a large swelling just behind the genital aperture, caused by the presence of an egg-capsule. This is a round or oval body with a chitinous shell, smooth and shining, and of a brown colour while in the uterus and for a day or so after laying; afterwards it turns to a shining black. The normal method of laying the capsule appears to be through a rupture of the dorsal tissues, through which the capsule passes; the wound so formed heals quickly.

During periods of drought planarians burrow in the soil, and construct hollow globular cells in which they lie dormant until favourable conditions again prevail.

T.S.

Landsborough, WILLIAM, third son of David Landsborough the Scottish naturalist, was born at Stevenston in Ayrshire, and while still very young migrated to New South Wales and took up pastoral work in New England. In 1853 he went north to the Burnett district, and in 1854 took up a run on the Kolan River W. of Bundaberg; in 1856, finding his run unprofitable because of drought and hostile blacks, he began to investigate the northern area of the Fitzroy watershed (the Isaac River), passing to the southern area (the Comet River) in 1858, and in the next year crossing the main range to the head-waters of the Thomson. He was therefore well known as an expert bushman when in 1861 the Queensland authorities decided to send out a party in search of Burke and Wills, and chose him to head the party. His work on this expedition is described under EXPLORATION BY LAND. He was unjustly accused of forgetting Burke and Wills in his desire to discover new pastoral country, but was honoured and rewarded for his achievement both in Melbourne and by the Royal Geographical Society. After visiting India and Europe, he returned to Queensland, and in 1864 was nominated to the legislative council, but the next year took the position of government resident in the Burke district at the southern end of the Gulf of Carpentaria; here he moved the official headquarters from Burketown (which he found unhealthy) to Sweers Island off the coast. His love of exploration, however, was unabated, and during his stay in the north he investigated the head-waters of the Diamantina and its tributary the Western River. In 1869 he left the residency, some years later was given a minor official appointment near Brisbane, and in 1882 received a grant of £2000 for his services as an

explorer. He died at Brisbane on 16 May 1886.

Lane, WILLIAM (1861-1917), born in Bristol on 6 September 1861 and educated at the Colston grammar school in that city, left England for Canada at the age of 14 and, after some hardships, found his way into the composing-room of a newspaper office. He practised journalism in both Canada and the United States, and in 1883 migrated to Australia. There he worked for most of the leading newspapers, but was especially connected with the *Brisbane Courier*; this he left to edit a weekly journal, *The Boomerang*, of which he was part-proprietor. He was much interested in the Labour movement, and through the *Boomerang*, various pamphlets, and debating circles reached not only the artisans and mechanics of Brisbane but also miners and shearers in the backblocks, familiarizing them with the doctrines of Marx, Belfort Bax, Bellamy, and Henry George. His influence became still more dominant when in March 1890 he established the Queensland *Worker*, the first Labour paper in Australia, on the basis of a regular subsidy from the trade unions, the paper being thus made independent of advertisements. Its motto was 'Socialism in our time.' Lane had been largely responsible for the formation in 1889 of the Australian Labour Federation—whose platform marked a distinct advance towards state socialism—and this brought him in close touch with the Labour organizations of the various colonies. He was instrumental in raising £30,000 to assist the London dockers' strike of 1889-90, and actively organized the maritime and pastoral strikes of 1890-1. In 1892 he wrote under the pseudonym 'John Miller' a novel, *The Working Man's Paradise*, to assist the fund which was being raised for men imprisoned as an outcome of the shearers' strike. But he was by this time convinced that neither political nor industrial action could bring about 'socialism in our time' with society constituted as it then was. He therefore developed plans, which he had been considering for some years, for the establishment of a utopia in a virgin land by ardent disciples of the new faith. Three experienced bushmen whom he had sent in search of a suitable country for the experiment reported very favourably on Paraguay, where they were warmly received by the authorities, and promised a free grant of 450,000 acres of agricultural and grazing land. Meanwhile the 'New Australia Co-operative Colonization Society' had been organized by Lane and his supporters, and the *New Australia Journal* established to further the scheme. The society was to be based on communal ownership and control of the means of production, exchange, and distribution; communal saving of all necessary capital; marriage; the maintenance of children by the community under the guardianship of the parents; equality of the sexes; and non-recognition of any special religious creed. In a short time £30,000 was paid into the coffers of the association. Each prospective male member of New Australia was obliged to pay at least £60 into the general fund, and those with more were expected to contribute all they had. Lane gave £1000, others as much as £400. The sailing-vessel *Royal Tar* (600 tons), purchased for £1620, left Sydney on 16 July 1893 with the first party—209 passengers and a crew of 32, all members of the association. But even during the voyage there was dissension. It was provided by the constitution of New Australia that decisions should be made by a two-thirds majority; since the members who remained in Sydney had vested their authority in Lane, he could dictate as he liked to the party aboard ship. This was resented, especially on one occasion when he ordered the women to remain in their cabins after dark. Another cause of trouble arose after the arrival of the ship at Monte Video on 13 September. The members had pledged themselves to teetotalism until the initial difficulties should be overcome, but at Monte Video some of them obtained liquor. This was not only a breach of the pledge, but also demonstrated that the delinquents had retained private moneys, contrary to the fundamental rule of the association. Some measure of harmony was restored, and the party proceeded upstream to Asuncion and thence, via Caballero, to the site of New Australia, which was reached with difficulty on 4 October. The government of Paraguay constituted New Australia a separate district—thus removing it from the control of local magistrates—and in order to secure local autonomy appointed to official positions three nominees of the colonists. Lane thus became a magistrate and administrator of the colony. Unfortunately the party was ill-equipped with the necessary implements, and many of the members were ill-suited to the work, though all had been carefully selected before leaving Sydney. They were plagued with strange insects; they had to construct their buildings of adobe (bricks of unburnt mud)—a material generally used in South America and well suited to local conditions, but unfamiliar and disheartening to Australians; complications arose in connection with the distribution and use of the communal income, and it was evident that hardships were imminent as soon as the capital fund was expended. Men accustomed to a roving life found their new employment monotonous, and sought diversions elsewhere. Three visited a neighbouring village and got drunk, and Lane decided, despite many objections from other members, that the offenders must be expelled. Using his authority as a magistrate, he brought Paraguayan police to the settlement to effect the expulsion. When the men left, accompanied by some of the protesting families, they had only £3 each wherewith to meet the future; this caused a definite split in the colony, and 85 members seceded in a body. The British consul at Asuncion, unable to provide for all these destitute people, tried in vain to patch up a truce between them and Lane. Most of them were finally repatriated to Australia.

Meanwhile a second party had sailed from Adelaide on 31 December 1893. They had heard the news of the secession, but in a mistaken form (the cabled message mentioned 8 seceders, instead of 85), so they were not disheartened. On their arrival in New Australia they were met by Lane, and taken to a site about ten miles from the original settlement. A second crisis arose when the newcomers under Gilbert Casey insisted on a change of leaders. Lane bowed to the general desire, telegraphed to his associates in Australia for power to reinstate the democratic constitution—which had been suspended before the first party left Sydney—appointed a chairman with a board of management, and then left New Australia with 45 adult sympathizers, 12 children, some implements and a few cattle. He applied to the government for a further grant of land, but the

only land offered, after two months' waiting, was in an unsuitable district without access to market. Fortunately, one of his followers—David Russell Stevenson, a cousin of Robert Louis—received from Scotland a legacy of £150, which served as a deposit on the purchase of 5½ leagues of good land at Caazapa, and there the Cosme colony was founded in July 1894. During the first two years the little band of idealists suffered great hardship, the payment of the annual instalments being a big tax on their resources. Nevertheless they continued to compile 'a written witness of their unfailing cheerfulness for the edification of future Cosmans'—the *Cosme Evening News*. On 25 June 1896 the government of Paraguay, satisfied as to the good faith of the Cosmans, paid the balance of the purchase-money on the land (£200), reimbursed them what they had already paid, and extended their territory another league. The only condition attached to the grant was that 72 families must be settled on the land within two years.

At the time there were 50 men and 20 women in the colony. This disproportion between the sexes was in itself a serious problem, and Lane feared that the bachelors might yield to temptation and take wives from among the graceful and industrious native women of the neighbouring districts. To meet official demands, and also to correct this disproportion, he decided to visit England on a recruiting campaign, with the object of securing 22 married couples and 30 single women as a minimum. He sailed for England in September 1896, having first arranged with the Paraguayan government to grant assisted passages to the selected colonists and to establish a Cosme agency in the Paraguayan consulate at London. A number of recruits were despatched to the colony from England, but their arrival led to jealousy and strife, with the result that many of the newcomers and some of the old members abandoned the settlement; consequently on his return Lane found Cosme weaker in numbers than when he left it. In 1899 he vested his authority in his brother John, and abandoned the task he had undertaken with such high hopes six years before; he remitted money, however, until—following the introduction of native labourers on a wage-system—the settlement lost the character of a co-operative commonwealth. He also set himself to repay to all who had left the colony, and who claimed a refund, the amounts they had originally paid into the funds; and he was still doing this at the time of his death.

After leaving Paraguay Lane visited New Zealand, and joined the staff of the *New Zealand Herald* as a leader-writer. In a few months he resigned this position in order to re-establish the Sydney *Worker*, but his Imperialist views, especially on the issue of the South African war, proved unacceptable to his associates. He therefore in 1900 severed his connection with Australian Labour politics and returned to the staff of the *New Zealand Herald*. He became editor of the paper in October, 1913, and retained that position till his death. During his long connection with the *Herald* he wrote under the pen-name 'Tohunga' weekly articles, many of which have been collected and published in book form. He also interested himself in defence policies, and was chiefly responsible for the organization of the National Defence League in 1906. On the outbreak of war in 1914 he associated himself with the Auckland Soldiers' Club. He died on 26 August 1917.

Lang, JOHN DUNMORE (1799-1878), born at Greenock in Scotland on 24 August 1799, entered the university of Glasgow at the age of 12 (M.A., 1820; D.D., 1825) and received his licence to preach from the presbytery of Irvine on 1 June 1820. Hearing from his brother George, who had taken up a grant of land in New South Wales, that the moral condition of the colony was shocking, he determined to establish Presbyterianism therein and for that purpose was ordained by the Irvine presbytery on 30 September 1822, left Leith in the *Andromeda* on 14 October, and arrived in Sydney (via Rio de Janeiro and Hobart) on 23 May 1823. His family followed in January 1824. At the time the only Presbyterian church in the colony was that built by a group of devout Scots at Ebenezer on the Hawkesbury river; Lang was therefore obliged to hold his Sydney services in the court-house, which was lent to him temporarily by the governor. On 1 July 1824 the foundation-stone of the Scots church on Church Hill was laid; financial assistance to meet the expenses incurred in connection with the new building was refused by Governor Brisbane, whose sympathies had been alienated by Lang's indiscretion and vindictiveness, but was subsequently granted by the colonial office up to an amount not exceeding one-third of the estimated cost. With Lang's consent this arrangement was altered shortly afterwards, a regular salary for the minister being substituted for the grant; before, however, official information of the change was received in Sydney, the colonial treasury had contributed 2400 Spanish dollars to the building fund, and though the colonial office directed Darling to insist on repayment there is no record of any refund. The Scots church, over which Lang was to preside as minister until 1878, was opened on 16 July 1826.

Indefatigable in his efforts to raise the moral tone of the community, Lang next turned his attention to education. Having determined to establish a Presbyterian college in Sydney 'to afford the youth of the colony a liberal, efficient and economical education,' he again visited England to secure the requisite financial assistance. The colonial office at first agreed that £3500 should be advanced to him in instalments as the building progressed, but this arrangement was modified at a later date to permit the use of part of the money to defray the cost of transporting to the colony 100 Scotch mechanics and their families, who arrived in Sydney with Lang on 13 October 1831. The scheme met with considerable local opposition, partly because Lang was suspected of stealing a march on the two King's schools (see SCHOOLS) which were being planned, and partly because he had roused the anger of the Anglican community by proposing that money for subsidizing the migration of poor agricultural families from England to the colony might be raised by the gradual sale of the lands of the Clergy and School Corporation—which, he alleged, were grossly mismanaged. Consequently, to meet liabilities incurred by the introduction and temporary maintenance of the mechanics (of whom, by the way, Bourke spoke highly) Lang was forced to sell his personal property. Nevertheless the new college building was completed in 1835, and was at once occupied, classes having been opened two years earlier. For the subsequent history of the college see SCHOOLS. Since 1833 Lang had also sought help to establish parish schools in connection with each

Presbyterian congregation throughout the territory.

Meanwhile he continued his ministerial work. A number of ministers having been introduced into the colony through his instrumentality, the first presbytery of New South Wales was formed in 1832, and in 1835 he organized a presbytery in Tasmania. Being dissatisfied with the number and character of preachers available, he returned to Scotland in 1836 to secure more recruits. On 3 September 1837 he again reached Sydney with eight Presbyterian ministers and four probationers; but, as the local presbytery held that only ministers in charge of congregations could under the terms of a recent declaratory act of the Church of Scotland become members of that body, the recruits could neither take part in the presbytery's deliberations nor claim allowances from the colonial treasury until they received a 'call.' Lang, who had already denounced some resident ministers for dissolute conduct, now proceeded, with nine other clergy, to form a new synod claiming authority over the Presbyterian Church in the colony; whereupon the acting-governor (with the advice of his executive council) refused to make any allowance from public funds to members of the synod other than Lang—who was already in receipt of a salary. Until 1840 Presbyterianism was divided against itself. In 1839 Lang again went to Great Britain on behalf of the synod, but accomplished nothing; the colonial committee of the general assembly of the Church of Scotland considered the journey unnecessary, and the colonial office refused to give him the usual half-pay during his absence. Before his return the schism was healed, the two bodies amalgamating in 1840 under the title of the 'Synod of Australia in connection with the Established Church of Scotland.' On his return Lang was admitted a member of the new synod, and at once proceeded to Port Phillip and Tasmania to gain support for the new doctrine of dissociation of church from state. The synod admonished him for his frequent absences from duty; he threatened to leave the colony, but finally agreed to remain with his Scots church congregation on condition that they broke all connection with the state and dissociated themselves from the synod. For this decision Lang was deposed by the synod, whose decision was confirmed by the presbytery of Irvine. Once again Lang went back to Scotland, laid his case personally before the Church authorities, and returned to the colony fully accredited as an ordained minister of the Church of Scotland; but his deposition was not rescinded by the local synod until 1863.

One service which Lang rendered to the colony during this period was the introduction of three German (Lutheran) missionaries with assistants to establish a mission-station for aborigines at Moreton Bay. He next interested himself in politics, and in 1843 took his seat in the new legislative council as one of the six representatives for the Port Phillip district. From 20 August 1844 (when he moved a resolution for the speedy and entire separation of Port Phillip from New South Wales) until Victoria became a separate colony, he took a prominent part in the separation movement. He also interested himself in immigration, and to counterbalance the effect of the continued introduction of poor Irish farmers decided to encourage settlers from Scotland. A tour of inspection made in 1845-6 through the Port Phillip and Moreton Bay districts convinced him that the Port Phillip district, if opened up by a railway, would be eminently suitable for agricultural development, and that a large inflow of migrants could be absorbed immediately at Moreton Bay if they set themselves to cotton cultivation on small holdings (see COTTON). In his opinion the cotton crop would prove the best means of establishing the group settlements he had in mind. Having resigned his seat in the legislative council, he again proceeded to Great Britain, and on arrival published two books (prepared during the voyage) setting forth the attractions of 'Phillipsland' (the Port Phillip district) and 'Cooksland' (the Moreton Bay district). He succeeded in organizing a group of about 600 'virtuous' migrants, who proceeded to the colony on the understanding that they would receive, on arrival, grants of land equivalent in value to the cost of their passage out. The colonial government, however, refused to comply with this arrangement, and the experiment involved Lang in many difficulties and great expense.

On his return to Sydney Lang again entered the legislative council as a member for Sydney, and acted on different occasions as an intermediary between the anti-transportation league (see TRANSPORTATION) and the government. In 1854 he was returned to the council as a member for Stanley (Moreton Bay) and at once threw himself wholeheartedly into the growing agitation for separation from New South Wales. Separation and federation were essential steps in the realization of his political ideal—Australian independence of Great Britain. This he had already embodied in *Freedom and Independence for the Golden Lands of Australia*, which was written in 1852 during his seventh voyage to England. His free and united Australia was to consist of seven provinces: South Australia, Victoria, Tasmania, New South Wales, and three new provinces to be carved out of the northern districts—'Cooksland,' 'Leichhardtsland,' and 'Flindersland.' Leichhardtsland and Flindersland he subsequently renamed 'Capricornia' and 'Carpentaria.'

Lang was unable to contest the first elections under responsible government owing to a clause in the Imperial statute which made ministers of religion ineligible for a seat in the legislature; in 1859, the clause having been repealed in the meantime, he was returned to the assembly and retained his seat until 1869, when he abandoned active politics. During his political career his interest in education never flagged; he also advocated a liberal franchise, land reform, triennial parliaments, postal reform, and the abolition of state aid to religion.

Throughout his career he was an indefatigable pamphleteer, and found time also to write numerous books, usually of a highly controversial nature. Several of these have been already mentioned; the following list (which is merely a representative selection) will give some idea of Lang's many-sidedness:—*Aurora Australis* (poems, 1826), *Origin and Migrations of the Polynesian Nation* (1834; 2nd edition, 1877), *Historical and Statistical Account of New South Wales* (1834; other editions, 1837, 1852, 1874), *Religion and Education in America* (1840), *Freedom and Independence for the Golden Lands of Australia* (1852; 2nd edition, 1857), *Queensland, Australia* (1861), *The Coming Event*, an enlarged reprint of *Freedom and Independence*, (1870), *Poems, Sacred and Secular* (1873). In 1835-40 he published *The Colonist*, a weekly journal in which he discussed questions of the day with a vigour that frequently brought

him into collision with the government. On 7 October 1841 he issued the first number of *The Colonial Observer* (which was in 1845 taken over by Anglicans and became *The Sentinel*), and in October 1851 produced *The Press*, which lasted until his departure for England in 1852. During the seventies he devoted most of his failing energy to his ministerial work, and in 1872 (the year of his ministerial jubilee) was made moderator of the general assembly of the Church in New South Wales. He died on 8 August 1878.

Lantana. See NOXIOUS PLANTS.

La Pérouse, JEAN-FRANCOIS DE GALAUP, COMTE DE (1741-1788), was born at Albi in the province of Languedoc on 23 August 1741. The name by which he is known to history is derived from Peyrouse, one of the family estates, but he never used the full 'de la Peyrouse' which was his right, preferring to sign himself 'Lapérouse,' as his descendants do. His desire for a naval career showed itself at an early age. He read many accounts of voyages and travels, and his imagination was specially kindled by the discoveries of the English Anson, the South Sea explorations of Louis de Bougainville, and the work of Byron, Carteret, and Wallis. The chief influence upon his mature mind, however, was that of James Cook. One of the most moving passages in Lapérouse's *Journal* was a eulogy of Cook, prompted by a visit to the island where the great English sailor met his death; and when, shortly before he sailed on his last voyage, Banks sent him from England two magnetic needles which Cook had used, he acknowledged that he received them with 'feelings bordering on religious veneration for the memory of that great and incomparable navigator.' His father supported his wish to go to sea, and in November 1756 he entered the French Marine as a royal cadet, commencing active service in the following year on board the line-of-battle ship *Celèbre*. From that time until his death 31 years later he was almost continuously afloat. Up to 1763 he was in the thick of the naval war. In the battle of Quiberon Bay (November 1759) he was aboard the French flagship *Formidable*, which was captured, and spent a short time in England as a prisoner of war. In 1775 he was in the East Indies, and in the Mauritius met the girl whom he afterwards married; from 1778 to 1782 he served on the coast of North America under D'Estaing and Latouche-Treville. By 1785 he was a post-captain with an excellent record; he had attracted the attention of de Castries, the minister of marine; and when Louis XVI needed a gallant and able man to command an expedition of special importance, Lapérouse was the obvious choice.

In 1785 Louis XVI (who also was much interested in voyages of discovery) decided to fit out an expedition of exploration to the South Seas, western America, and eastern Asia. The king's study of Cook's voyages had convinced him that there was a large amount of original work still to be done in those regions. At his direction, therefore, a plan of research was prepared by Charles Claret, Comte de Fleurieu, a well-known writer on geography and navigation. Two ships of the navy, renamed *La Boussole* and *L'Astrolabe*, were selected and the command given to Lapérouse. The instructions given him were both precise and lengthy. He was to round Cape Horn, visit various island groups on his way across the Pacific, investigate the Louisiade group off eastern New Guinea, pass Endeavour Strait, examine if possible the Gulf of Carpentaria, and then coast Australia west-about to the southern end of Tasmania. Thence he must follow Tasman's tracks to Cook Strait in New Zealand, cross the Pacific to the western coast of North America, and return to Europe via the China Seas, the Philippines, the Moluccas, and Timor. It will be noted that the eastern coast of Australia—the part skirted by Cook—was deliberately omitted; Louis, who admired Cook as much as Lapérouse did, was loth to do anything that might seem to threaten his work, even his annexation of New South Wales for Britain.

Sailing from Brest on 1 August 1785, the expedition rounded Cape Horn in January 1786, and, after spending some weeks on the Chilian coast, visited Easter Island (April) and the Sandwich group (May). Here Lapérouse seems to have decided (as he had permission to do) that the arranged route could profitably be reversed. He went directly north to Alaska (June to August), ran down the western shores of America to California (September), and thence struck westwards across the Pacific to the Ladrones (December), Macao (January 1787), the Philippines, Formosa (April), Japan (May), and Kamchatka. Here the drawings and journal up to date were packed up and sent to France overland in charge of J. B. B. de Lesseps (the only member of the expedition who ever returned to Europe), and letters received from France informed Lapérouse of the British expedition to Botany Bay and bade him visit the new settlement. He next sailed for the southern Pacific, reaching the Samoan group early in December. At Tutuila (which he knew as Maüna) a tragedy occurred. Captain de Langle, commander of the *Astrolabe*, went ashore with a party to obtain fresh water, was attacked by natives, and killed; 11 of the crew shared his fate, and 20 others were wounded. The loss of the services of 32 men was a serious embarrassment, and Lapérouse determined to make straight for Botany Bay to get wood and water, and to put together two new longboats to replace those destroyed at Tutuila. Norfolk Island was reached in January 1788, but no landing was made. On 24 January the two French vessels were beating up off Solander Point. Only six days earlier Phillip had arrived in Botany Bay. At the moment when the foreign flags were sighted by the English, Phillip was about to set forth in the *Supply* to Port Jackson. Heavy weather prevented Lapérouse from entering the bay till the morning of 26 January; when at length his ships came to anchor, Lieutenant King of the *Sirius*—on behalf of Captain Hunter, who was just about to convoy the fleet round to Port Jackson—paid a visit of courtesy to the *Boussole*. Lapérouse had heard at Kamchatka that the British intended to found a settlement in New Holland, but had no idea what progress they had made. He told Paterson that he expected to find a town built. Instead of that he found Phillip abandoning the site first chosen—an action with which, after some experience of the bay, he cordially agreed.

Phillip and Lapérouse did not meet, but other British officers paid friendly visits to the French, and mutual relations were unexceptionally cordial. In his conversation, as in his writings, Lapérouse lost no opportunity of expressing admiration for the person and work of Cook. The *Boussole* and the *Astrolabe* sailed from Botany Bay on 10 March. From that moment they disappeared from view, and all

trace of them was lost for nearly 40 years. A search expedition in command of Dentrecasteaux, despatched from France in 1791, failed to solve the mystery, and it was not until 1826 that Captain Peter Dillon (q.v.), sailing from Valparaiso to Pondicherry in the *St. Patrick*, called at Tucopia (Barwell Island) and was put on the right track. Dillon's curiosity was aroused by an old silver sword-hilt, sold to a member of his crew, and he elicited the information that this and other relics were obtained from Vanikoro in the New Hebrides. At the end of the year Dillon was sent from Calcutta in the *Research* to make a systematic search of that locality; and his investigations left no doubt that Lapérouse's ships had been driven ashore there by a storm in 1788 and totally wrecked, and that a few survivors who attempted to escape in a boat were also drowned. Dumont-Durville in a new *Astrolabe* in 1828 made additional discoveries. The relics of Lapérouse are now exhibited in the Marine Museum at the Louvre, in Paris, and his memory has been kept fresh in Australia by the maintenance of a monument, erected by Bougainville in 1825-6, on the site of the French camp. This site was set aside by Brisbane for the monument and for a tomb over the grave of Father Receveur (q.v.); in 1880 Captain Mathieu of the French navy tried to purchase it, but the needs of coastal defence prevented the alienation. On 14 July 1917 the New South Wales government announced that it had been given to the French nation in perpetuity. E.S.

Laportea, a small genus of the family Urticaceae, widely distributed (especially in Malaysia), consisting of trees or shrubs with rigid, stinging hairs. The flowers are unisexual; the females enlarge after flowering and combine with the succulent flower-stalks. *L. gigas* (Stinging Tree or Giant Nettle) known by the aborigines on the northern rivers of New South Wales as 'irtaie,' secretes a poisonous fluid, very powerful in the young leaves, whose sting is exceedingly virulent and infuriates cattle. Juice from the leaves or stem of the cunjevoi (q.v.), or slices of the stem of the stinging tree itself, are usually applied as antidotes. The bark yields an excellent fibre of good colour. The inner bark is beaten into a coarse cloth similar to the tapa cloth which South Sea islanders make from the Paper Mulberry (*Broussonetia papyrifera*). The best and strongest fibre is obtained from the root-bark; from this, after chewing it, the aborigines make fishing-nets and lines.

Larks and Pipits, perching birds, terrestrial in habit, belonging to the families Alaudidae and Motacillidae. The true larks (Alaudidae) are represented in Australia by one or more species of the genus *Mirafra* (known as bush-larks), and by the introduced European Skylark (*Alauda arvensis*) which is thoroughly acclimatized in the outskirts of Melbourne and Sydney. Bush-larks range from Africa through southern Asia and the Malay Archipelago to Australia. They are rather small birds, with mottled brown plumage, lighter underneath, with dark spots on the breast. They frequent open grassy or heathy country, running when on the ground. The song, which is a fine one, uttered on the wing high in the air, is not infrequently heard on moonlight nights as well as in the daytime. The nest is a partially-domed structure of dry grass, built in a hollow beneath a grass-tuft. The three eggs are greyish-white, marked all over with brown and purplish spots. One species (*M. javanica*) is found throughout Australia and extends to Java. Specimens from the north-west of the continent are often smaller and

Lark (*Mirafra javanica*).

much more rufous in colouring, and are regarded by many authors as a distinct species (*M. woodwardi*).

The Australian Pipit (*Anthus australis*)—generally called 'ground-lark'—is, though a member of a distinct family, surprisingly like the bush-lark. The genus to which it belongs is probably more universally distributed over the globe than any other genus of birds, and our species resembles the majority of its congeners in plumage and habits. It frequents open country, especially grass-lands, and, owing to the clearing of the bush over wide areas, is undoubtedly becoming more and more common. Its nest is a cup-shaped structure of grasses, built at the base of a grass-tuft; the eggs closely resemble those of the bush-lark. In the breeding-season it utters a pretty song, rising up as it sings to some height in the air, and performing part of a circle before descending.

The true wagtails of Europe, which belong to the same family (Motacillidae) as the pipits, are quite unconnected with the Australian wagtail, which is one of the family of flycatchers (q.v.). A single specimen of a true wagtail was shot in 1905 on the Dawson River in south-central Queensland, and proved to be an example of the variety of the Yellow Wagtail (*Motacilla flava*) which breeds in Kamchatka and winters in China and Malaysia. As it was obtained in June, the season when it should have been in Kamchatka, it had probably travelled south instead of north from its winter quarters.

Other birds known in Australia as larks, but not belonging to either of the families dealt with above, are the song-larks, the subject of a separate article (q.v.), the field-lark, one of the warblers (q.v.) and the magpie-lark (q.v.). W.B.A.

Latrobe, CHARLES JOSEPH (1801-1875), born in London on 20 March 1801, was the son of a Moravian minister stationed in Yorkshire. He himself invariably spelt his name 'La Trobe;' the spelling adopted here is that used by his family before and after him, intermittently in official documents concerning him, and almost universally by his biographers. He received the education usually given to students for that ministry, but abandoned the profession shortly after he came of age, and led a roving life for about 13 years—travels in Switzerland (1824-6), the Tyrol (1830), and the United States (1832-5) occupying most of his energies. In 1834 he and Washington Irving crossed together the Texas prairies on a journey

from New Orleans into Mexico, and Latrobe published an account of it as *The Rambler in Mexico* (1836). As a result of this publication he was in 1837 commissioned by the colonial office to report on the administration of a fund intended to promote education among the West Indian negroes. In 1839 the colonial office, advised by Bourke that the rapidly growing settlements on Port Phillip needed the control of a resident official with the powers of a lieutenant-governor, offered the position to Latrobe, though the title was refused him. He reached Sydney on 26 July 1839, and after long consultations with Gipps reached Melbourne on 1 October and took up his duties as superintendent of Port Phillip. For a few months in 1846-7 he was in charge of Tasmania also. His administration lasted from 1839 to 1854—a period of exceptional difficulty marked by two grave financial crises (arising out of the land speculation of 1838-42 and the gold discoveries of 1851-2), and quite beyond the administrative control of an inexperienced man.

His first arrival, however, was greeted with rejoicings and panegyrics as well as with eager demands for reforms of all sorts. More especially did the residents of Port Phillip desire the expenditure of their own revenues on local improvements. In the six years ending in 1842 those revenues (including land-sales) exceeded local expenditures by £362,000, and of this surplus £158,000 was spent at the Sydney end of the colony. Latrobe (as the date just mentioned will show), although he sympathized strongly with the residents, did not easily obtain satisfaction for them: but in 1842 he secured from the unreformed New South Wales legislative council an act incorporating the town of Melbourne, which to some extent relieved the strain. Even this, however, did not restore his already waning popularity. He was in a very difficult position: he was neither a governor, answerable only to the distant colonial office, nor a lieutenant-governor nominally subordinate to Gipps but practically independent, but only a 'superintendent,' unable to make any important decisions without first obtaining the approval of Gipps—which during most of his term involved also the approval of a suspicious and often hostile legislature in Sydney. Lacking self-confidence, and deeply impressed with the ability and experience of Gipps, he was incapable of strenuous resistance—such as Port Phillip colonists expected—to any policy laid down in Sydney. Consequently he had less influence on the development of the settlement than any other official in a similar position before the institution of responsible government, and at the same time was more bitterly attacked for what he did not do than other governors for what they did. The history of Victoria under his nominal rule will be found in the article on that State: here we shall be concerned chiefly with matters in which he exercised some influence.

It was by his efforts, for instance, that a resident judge was appointed to Melbourne in 1841 (unfortunately the first man sent down was totally unfit for the position). In the movement for separation which occupied nearly the whole of the forties he was either negligible or a hindrance, since he felt that Port Phillip was not fit to be trusted with an elected council, and the New South Wales executive council consequently advised the colonial office in 1846 that only a nominee council should be granted. On one occasion, however, Latrobe (having been previously assured of Governor Fitzroy's backing) placed himself at the head of a popular movement and gained great credit thereby. On 8 August 1849 the convict transport *Randolph* dropped anchor in Hobson's Bay: on the 11th she passed the heads again on her way to Sydney without having attempted to land a single convict, and Latrobe was for a time the best-loved man in Melbourne. Though they attracted little attention at the time, his forethought in reserving from sale by auction the lands since known as the Fitzroy and Carlton gardens, and his establishment of the botanic garden on the southern bank of the Yarra opposite his own residence at Jolimont, are valuable results of his initiative where he could exercise it.

The burlesque election of Earl Grey as member for Melbourne in the New South Wales legislative council (1848) shocked Latrobe deeply, but he thankfully left it to be dealt with by Fitzroy. When the 'separation act' of 1850 was passed, Fitzroy summoned him to Sydney to help in the preparation of the necessary legislation, and it was partly by his advice that the act contained a provision which still dominates Victorian electoral law—the allotment of more representation to country districts, in proportion to population, than to the cities. In 1850 the discrepancy between town and country was 7 to 1: in 1924 it was about 2½ to 1. When separation became a fact, Latrobe was made lieutenant-governor of the new colony; but that comparative peace to which he might have looked forward was promptly made impossible by the gold discoveries which were publicly announced ten days before his formal admission to the new office. The effect of these discoveries on Victoria is narrated under GOLD, DISCOVERY OF; on Latrobe their effect was to distract him beyond measure. He began by copying the New South Wales regulations, which did not at all suit the circumstances of Victoria: every attempt he made to procure money for strengthening the forces of law and order was thwarted either by the new legislative council or by a defiant public opinion: the vehemence on the one hand of the squatters, who demanded immediate survey and undisturbed possession of their runs, and, on the other hand, of the diggers who claimed the right to enter any area in search of gold and to have good land thrown open to them whenever they should decide to settle down as farmers, kept him hesitating between two claims equally just and at the moment equally inexpedient: and his known dislike of the measures which the council took to prevent the immigration of convicts from Tasmania did but emphasize the animosity with which nearly all classes of the community now regarded him. Latrobe struggled on, anxious only to reconcile the dictates of his conscience with the immediate necessities of keeping the peace and maintaining the administration; but, when early in 1854 he received from the colonial office a snubbing and unsatisfactory reply to a despatch of September 1852, he resigned office and left the colony on 5 May. The rest of his life he spent in retirement in England, dying at Litlington near Eastbourne in Sussex on 2 December 1875.

Apart from his much troubled political career Latrobe was active in providing Melbourne with many institutions of great value. He helped to establish the Melbourne hospital, the public library, the benevolent asylum, and the university, and strongly backed, if he did not initiate, the Yan Yean water-supply scheme. He was probably the best-intentioned governor who ever functioned in Australia: but it was his ill luck

to be set to encounter, without the necessary temperament or experience, some of the most tempestuous crises known in our history. (C.B., 1858.)

Laughing Jackass. See KINGFISHERS AND BEE-EATERS.

Launceston, the second city of Tasmania, is situated in 41° 25′ S. lat. and 147° 10′ E. long., about 42 miles from the sea, at the confluence of the North and South Esk rivers—which, united, form the Tamar. The site was discovered on 9 January 1804 by William Collins, who was sent from Port Phillip by David Collins (q.v.) to explore the Tamar River; it was more carefully examined in the following December by William Paterson (q.v.) who had provisionally established his settlement lower down the river near Yorkton (see TASMANIA). In November 1805, after a failure of the crops at Yorkton due to the poor quality of the soil, Paterson recommended that farmers should be granted land on the upper Tamar, and that the tract of good ground at the confluence of the North and South Esks should be reserved for official purposes. Governor King having approved the suggestion and named the proposed site Patersonia, part of the establishment was located there in March 1806. By the beginning of 1807 the name Patersonia had been discarded for Launceston, after Launceston in Cornwall, England, where King was born, the northern half of Tasmania being already known as the county of Cornwall. Paterson had not yet fixed definitely on a headquarters for the Port Dalrymple settlement. Launceston was the centre of the agricultural district, but the need for a trading-port in the estuary of the river was recognized; Yorkton was not well suited for this purpose, but there were other sites available. On 27 September 1807 Governor Bligh gave instructions that the permanent headquarters must be selected before anything else was done. If, as he thought preferable, a site were chosen where shipping could discharge, Launceston would be regarded as an 'outpost' in the agricultural district. It was decided, however, to move the whole establishment permanently to Launceston; by 1810 Yorkton was abandoned, and no other site was selected for an estuary-port. In 1810 Oxley wrote that no better headquarters than Launceston could have been fixed on, in view of the beautiful country surrounding it and its accessibility to vessels drawing not more than 12 feet of water. Nevertheless in November 1811 Governor Macquarie, during his official visit to Tasmania, formed the opinion that it had many disadvantages. The township was situated in a low marshy flat, surrounded by high hills; the river being tidal, there was no fresh water in the vicinity, and the inhabitants were obliged to bring it down in boats. They suffered also from high prices, which were due in the main to difficulties of navigation. Moreover, ships passing through Bass Strait felt the want of a port on the coast, where they could effect repairs and obtain stores. Macquarie, after carefully considering the whole situation, decided to remove headquarters to the site in the estuary originally named Outer Cove by Paterson—who had established his first settlement there, but abandoned it in favour of Yorkton on the opposite bank when the water-supply threatened to fail. Macquarie, however, believed that Paterson's fear of a water-shortage was groundless, as abundance of it for every purpose could be obtained from a number of springs. The expense of removing the official establishment from Launceston to the new site (henceforth to be known as Georgetown) would not be great, as the few public buildings in Launceston were in 'a most ruinous decayed state' and of little value. Macquarie realized that Launceston would remain the agricultural centre of the Dalrymple settlement, but anticipated that Georgetown would become a large commercial centre and port. The change over was to be effected as soon as official sanction was received from the colonial office.

This was given in a despatch dated 3 February 1814. Further delay, however, was unavoidable, owing to the difficulty of obtaining enough government artificers and labourers to erect the necessary buildings at Georgetown; moreover, while Major Stewart was commandant (1815-18), there were continuous dissensions among the officials. In May 1819, the necessary buildings having been constructed, Georgetown became the headquarters of the settlement; only an officer and a small detachment were left at Launceston. But since the arrival in 1813 of the settlers from Norfolk Island (q.v.) there had been a marked agricultural development round Launceston, and the shifting of the commandant 40 miles from the centre of his command caused considerable inconvenience to farmers and townsfolk. Commissioner Bigge strongly condemned the change; on 2 October 1820 he pointed out to Macquarie that the land about Georgetown was proved to be of the worst description, and the cove too small to offer much protection to shipping; moreover up-river agriculturists objected to having their principal market 40 miles away. He recommended that the official establishment be moved back to Launceston. The buildings already erected at Georgetown could house a naval officer for the protection of trade and a small military detachment to prevent the escape of convicts. But Macquarie was adamant. As well might the settlers of Windsor and Parramatta complain that the metropolis of New South Wales should be at one or other of those townships, rather than at Sydney! A second visit to Tasmania in 1821 only served to strengthen his opinion of the superior advantages of Georgetown. Nevertheless, while awaiting the decision of the colonial office on Bigge's report, he suspended construction-work in Georgetown and ordered several public buildings to be erected at Launceston—a gaol, military barracks, a hospital, a commissariat store and granary, and accommodation for a military officer and an assistant surgeon. He also agreed to order the commandant to grant no more land in the town without his sanction, and to reserve the hill immediately above the town for official purposes. In March 1823 Lieutenant-governor Sorell, with the sanction of Governor Brisbane, moved most of the convicts from Georgetown to Launceston in anticipation of instructions from the colonial office to effect the change recommended by Bigge. Sorell also arranged for the erection of additional public buildings, including a church. On 31 July 1823 the anticipated instructions were despatched, and in the following year Launceston was officially reoccupied as the headquarters of the northern command.

In 1826 the township was surveyed and laid out. By 1827 it was a town of about 2000 inhabitants; extensive cargoes of wheat and wool were loaded at Reiby's wharf (see REIBY, THOMAS) by vessels of 250 tons burthen. No trade was carried on at Georgetown, which now contained only about 150 inhabitants, mostly

convicts. Thereafter the progress of Launceston was continuous. In 1825 George Howe had established *The Tasmanian and Port Dalrymple Advertiser;* in 1829 John Pascoe Fawkner issued *The Launceston Advertiser.* In 1828 the Cornwall Bank was established on the corner of Cameron and Wellington-streets; the Tamar Bank was opened in 1833; the Savings Bank in 1835 and the Bank of Australasia in 1836; in 1838 both the Union and Commercial Banks opened branches. In 1834 the chutes in the Cataract Gorge were erected by Andrew Sibbald to supply water to his mill—and, incidentally, to the inhabitants of the town, who had previously been dependent on supplies drawn from a considerable distance. Launceston whalers had stations at Portland Bay and Encounter Bay on the mainland. On 20 November 1835 Launceston became a free port.

During 1835 the town sent out two expeditions of great importance to Australia. On 10 May Batman dropped down the river in the *Rebecca* on his way to investigate Port Phillip; on 29 July Fawkner's party left the Tamar to search Western Port and, in the end, founded Melbourne.

Nor was the cultural development ignored during this period of growing prosperity. Though Launceston had no regular theatre until 1845 (see DRAMA), it had during the thirties a makeshift playhouse in which dramatic performances were given. In 1842 the mechanics' institute was opened, a Church grammar school was established in 1846, and a chamber of commerce—the first in Australia—in 1849. During the gold-rush many people from Launceston flocked across the strait to Victoria, but when the fever subsided the town settled down to steady development under civic administration. As headquarters of the northern settlement Launceston was under the control of a commandant until 1846, when that office was abolished. In October 1852 it was proclaimed a municipality (see LOCAL GOVERNMENT) and a system of local government was instituted. At the time the population numbered about 7300. In 1857 a marine board was formed for the development of the port; in the same year a water-supply scheme was approved, and a drainage scheme for the main streets was carried out. In 1858 a gas company was formed. In 1863 the South Esk suspension bridge was built. The Launceston and Western railway, the first sod of which had been turned by H.R.H. the Duke of Edinburgh in 1868, was opened in 1871, and in 1876 Launceston was connected by rail with Hobart. During the seventies there was a rapid development of the mining industry in the neighbouring districts; near the town the Waverley woollen mills, the Mount Bischoff tin-smelting works and the Cornwall pottery were established. A stock exchange was opened in 1881. When in 1888 Launceston was proclaimed a city, its population had increased to 17,000 with property the assessed value of which totalled £120,539. During the early nineties the city suffered from the financial collapse that led to the closing of the Van Diemen's Land Bank. Electric light was installed in 1895; in 1897 work was begun on the Victoria hospital for women, an infectious diseases hospital, the Victoria baths, and Victoria bridge. In 1898 the city council took over control of the Cliff Grounds in the Cataract Gorge. Since the completion of the Great Lake hydro-electric scheme (see HYDRO-ELECTRIC DEVELOPMENTS) cheap power has been available in the city for industrial undertakings. The population of Launceston at the census of 1921 was 24,319. See TASMANIA.

G.H.W.

Lauraceae, a large family of trees or shrubs abundant in tropical Asia and America, less plentiful in Africa; a few species occur in temperate countries. Seven genera with 50 species are indigenous to Australia. *Hernandia* is a small genus of trees with a wide range, chiefly tropical and maritime. *H. bivalvis* (Grease-nut Tree) is limited to Queensland, where the aborigines call it 'cudgerie;' on the Richmond and Clarence rivers this name is given by the local tribes to *Flindersia australis.* The shells of the fruit yield a dye soluble in soda but not in ether, alcohol, or water. The kernels contain an oil like common laurel oil, with the same stearine and narcotic odour. *Beilschmiedia obtusifolia,* found in eastern Australia, is a large handsome tree with aromatic bark, and yields a useful timber. See CASSYTHA, CINNAMOMUM, CRYPTOCARYA, ENDIANDRA, LITSEA.

Laurel, a name applied not only to members of the family Lauraceae (see CRYPTOCARYA), but to trees and shrubs of several other families, notably to species of *Pittosporum* and *Eupomatia.* For the Alexandrian laurel see GUTTIFERAE; the dodder laurel is a *Cassytha.*

Lavatera, a genus of the family Malvaceae, mainly European: one species, *L. plebeia* (Tree Mallow), is endemic in Australia. This is a coarse erect herb that becomes woody with age, whose flowers shade from rose-colour almost to white. Readily propagated from seed, it is frequently grown as an ornamental garden plant. In South Australia the roots of a white-flowered variety have been largely used by the natives for food; they are somewhat of the consistency of parsnips. The fibre has been used for rope- and paper-making, and, by the aborigines, for baskets and fishing-lines.

Lawes, WILLIAM GEORGE (1839-1907), born on 1 July 1839 at Aldermaston in Berkshire, was educated at the village school and trained for a business life at Reading, but in 1858 was accepted by the London Missionary Society for work in the South Seas, receiving his theological training at Bedford, and being ordained to the Congregational ministry on 8 November 1860. In 1861 he passed through Sydney on his way to Niue (Savage Island), where he landed in August. During 11 years of work there he completed a translation of the New Testament into the local language, and when he returned to England on furlough in 1872 took this with him, as well as translations of the Book of Exodus and the Psalms. In April 1874 he was appointed to the New Guinea mission, and settled at Port Moresby, where he worked for 21 years; he founded a training-school for natives, reduced the Motu language to writing, translated the New Testament, and, in conjunction with James Chalmers (q.v.) assisted the British authorities when a protectorate was proclaimed over New Guinea. On leaving Port Moresby Lawes went to Vatoraat, which he had made the headquarters of the training-school. In 1896 he visited Australia to see through the press several works in the Motu tongue, including selections from the Old Testament, 204 hymns, a catechism, a form of religious worship, an arithmetic, and a grammar and dictionary. Though less of an explorer than Chalmers, he was able in 1905 to mark on a map

96 villages with which he had established friendly relations. In 1906 he left New Guinea to reside in Sydney, where he died from pneumonia on 6 August 1907. Besides the text books and translations mentioned above he published in 1884 a brief account of explorations in New Guinea. His biography, by Joseph King, was published in London in 1909. J.C.

Lawn Tennis. The actual origin in England of lawn tennis is shrouded in mystery, but it is clear that the beginning of the modern game was the adaptation of royal tennis into an outdoor game by Major Wingfield about 1870. English visitors to Australia brought out implements, and played in different centres, but the actual introducer of the game will probably never be known. By the early eighties, however, it was played privately at all main centres of population, and the Sydney club was one of the first to give the game a definite footing. In Melbourne championships began in 1880, but not till 1885 was the first intercolonial match played. By this time there were two distinct schools of play—the Victorian, produced by playing on asphalt courts with the uncovered ball that rebounded high (often right above the head of the player), and the New South Wales school, produced by playing on grass courts with the covered ball that rebounded far less and was more solid. Victorians were forced by the high rebound to chop the ball downwards, and to reach the net as soon as possible in order to volley; New South Wales players relied far more on driving from the base-line, or from behind it. These two schools of play still largely affect the players of each State, and even to-day we have in J. O. Anderson of New South Wales the ultimate product of the highest skill in driving, while Norman Brookes and Gerald Patterson of Victoria have shown to how high a pitch of skill the volley can be carried. Still, in later years the players of each State adopted the methods of visiting champions from overseas—Wilding, Alexander, Beals Wright—till in Victoria there grew up fine drivers (R. W. Heath, Brookes himself—who is almost as good a driver as a volleyer—A. and P. O'Hara Wood, J. B. Hawkes, I. D. McInnes and R. E. Schlesinger), and in New South Wales fine volleyers like Dr. G. G. Sharp and A. H. Windeyer. But most New South Wales players still rely on their ground-strokes.

After 1885 the annual intercolonial matches between New South Wales and Victoria, played in Sydney and Melbourne alternately, produced many stirring contests, the best of which were the fights between Dudley Webb (one of the finest drivers and all-round players Australia ever produced) and 'Ben' Green, a volleyer at all risks, who led the Victorians into battle with strict orders that it was the net or nothing. Malcolm and the Chomleys, who taught Victorians the method of following the service to the net in doubles, laid the foundations, A. W. Dunlop with Norman Brookes sustained the high standard, and to-day Brookes, P. O'Hara Wood, Gerald Patterson and J. B. Hawkes carry on the great Victorian tradition, both in volleying and in doubles.

In New South Wales the best players of the early days were C. W. Cropper (who not only played the game but organized it as well), the brothers Fitzgerald, Dudley Webb (who was born in New South Wales, but played first as a resident of Victoria), Harold Fox and P. B. Colquhoun. In 1887 Lord Carrington, then governor, took a great interest in the game, and his private secretary Captain Wallington played in the intercolonial team. Webb first played for New South Wales in 1887, and Ben Green first for Victoria in 1889, and these two continued to represent their colonies till 1895. In the intercolonial matches Green generally had the best of it, but in the longer championship matches, finished a week later, Webb each year outlasted Green. Still, the contests were so close that on one occasion, Green having been seized with cramps, Webb came up to the net to wait, and was himself suddenly afflicted in like manner.

The first champion of New South Wales was Salmon, in 1885. Then Cropper won for two years, and Dudley Webb won five times in seven years, his run being interrupted by the successes of Dr. Colquhoun (of Victoria) and Dr. Eaves. Since then the list includes H. R. Crossman (three times), A. Curtis, A. D. Kearney (twice), H. Rice, Dr. Eaves again, Dr. Sharp (three times), R. W. Heath, H. A. Parker, A. Campbell, A. B. Jones (1912), A. O'Hara Wood (1913), J. O. Anderson (1914), and M. H. Marsh, who won the championship in 1915, and held it during the war. In 1919 it was won by J. O. Anderson, in 1920 by R. Neil, in 1921 by G. L. Patterson, in 1922 by R. V. Thomas, in 1923 by J. O. Anderson, and in 1924 by G. L. Patterson.

Championships began earlier in Victoria. The first champion was Highett in 1880, followed by Whyte, Keyser, Whyte again, Brind, W. Riddell (twice), A. G. Colquhoun (twice), Shuter, Cramond, Kearney (four times in all), Ben Green (three times), A. W. Dunlop (twice in all), T. C. Irving, H. Rice, Brookes (three times in succession), R. W. Heath, H. A. Parker, A. F. Wilding (twice in succession), S. N. Doust, Brookes again, J. C. Parke in 1912, R. W. Heath in 1913, A. O'Hara Wood in 1914, Gerald Patterson 1919-24.

In 1891 came Dr. Eaves, a visitor from the more advanced school of England, destined later on to revolutionize the game here. Having beaten all the best players in Victoria, including Green, he visited Sydney as a member of the Victorian team, and reached the challenge round of the championship with little opposition, but had hard work to dispose of Webb. His play taught Australians a good deal, and the Victorians profited most, for on his advice they discarded in 1891 the use of the uncovered ball. Up to this time the doubles game had been played on the original plan—one player close in at the net to snatch up every chance of killing with an interception and brilliant volley, and the other racing round the base-line retrieving the tosses and drives; but (whether it was the visit of Eaves, or just a spirit of invention, cannot be ascertained) just about this time, both in Sydney and Melbourne, was inaugurated the plan by which players followed their services to the net to volley the returns. In Victoria this plan was first adopted publicly by the brothers Chomley; in New South Wales it was adopted by the brothers Fitzgerald, suggested independently to the present writer by T. Kidston, and adopted with some doubts but good success. At first it was almost thought unfair, as tending to put the receiver off his stroke; but it was soon universally adopted, and has been adhered to ever since, both here and all over the world.

The battles between the driving of New South Wales and the volleying at all risks of the Victorians continued till 1902, with no great advance in skill. In 1902 Dr. Eaves paid Aus-

tralia a second visit, having by this time improved so that he was perhaps one of the greatest players then in the world; he had gone within one point of winning the American championship singles, and was just as close to the English championship singles. He defeated the best players here, including Norman Brookes, by this time the best player in Australia. With the true instincts of a sportsman, however, he taught Brookes the finer points of the game, including the famous American twist services, and showed him the higher value of delicate placing and volleying. Brookes had already ground-strokes of a high standard; he now added volleying that has never been exceeded in skill by any player in the world, and a well-worked-out scheme of knitting his strokes into one concerted game that left no loopholes for defeat; and in addition improved the American service immensely, so that his service became known as the Australian service.

Thus stood Australia in 1902. At the dinner given to the visiting teams in Sydney Harold Fox suggested that Australia should enter a team for the Davis Cup matches, instituted in 1900 as matches between England and America. The suggestion did not bear fruit until 1905, when Norman Brookes and A. W. Dunlop were both in England on a visit, and a young New Zealander, Anthony F. Wilding, was resident at Oxford. These three played for Australasia, and met a strong American team, going down after a good fight. Brookes that year was defeated by H. L. Doherty in the challenge round of the English championship, but showed clearly that his play was of the highest standard, and in a later match turned the tables on Doherty. Next year only Wilding and Dr. Poidevin were available, but in 1907 Brookes went to England again—largely at his own expense, for the gate-money in those days was small. This time Brookes and Wilding achieved success after great contests with America and England; the Davis Cup was brought to Australia, and was retained in 1908 against the assault of Beals Wright and F. B. Alexander, the American representatives. It was the contests in Melbourne between these two teams that first showed Victorians how great a game lawn tennis is. Next year two colts from America, M. E. McLoughlin and M. H. Long (both under 20 years of age), extended even Brookes and Wilding, and these matches taught New South Wales players as the previous year's had Victorians. As a result 'country week' was initiated by country players who had assembled in Sydney to see the Cup matches. To-day 'country week' is the greatest carnival in the world in perhaps any single sport, and is growing so fast that it will be difficult in future to provide a sufficient number of courts.

Since 1907 Australasia has held the Davis Cup for 12 years, and at present Australian players stand in singles only second to those of the United States; in doubles Australia stands just as clearly first, by better methods of play and position. This is the result of nearly 40 years of intercolonial and inter-State matches.

In *Queensland* there has been ever since 1895 a strong body of players. The best is C. B. St. John, who, though disabled from birth by the lack of a right hand, has conquered this defect, and is a fine all-round sportsman—including cricket and football—as well as the best lawn tennis player Queensland has ever produced. *Tasmania* has had one player of outstanding merit in J. McGough, who won the State championship 14 times in all. In *South Australia* the game has flourished for 20 years; R. V. Thomas and G. M. Hone are outstanding players. In *Western Australia* the play is not of so high a standard; but the late E. F. Parker (killed in action) was one of the best players Australia ever produced, though his development was hampered by remoteness from other good players. R. H. Gemmell, the present champion, ranks high. Among *Victorian* players Norman Brookes, of course, has stood out most, but the record of Gerald Patterson for the last five years equals or excels that of any predecessor, and to-day he has only one peer in Australia, J. O. Anderson.

In *New South Wales*, after the retirement of Dudley Webb and H. R. Crossman, Horace Rice came into prominence; he has played in 60 intercolonial and inter-State matches over a period of nearly 30 years, has won championships in every State of the Commonwealth, and has played for Australia in the Davis Cup contest. Dr. G. G. Sharp has the best record—three successive wins in the singles and three in the doubles—and at his best was close even to Brookes. A fine doubles player was G. W. Wright, who with Dr. Sharp won the doubles championship three times, and also won it later with A. B. Jones—whose partnership in 1913 with S. N. Doust, another Sydney player, showed them to be the best pair in the world after the Brookes-Wilding or Brookes-Dunlop pair. In 1922 Patterson and P. O'Hara Wood defeated the American Davis Cup pair, Brookes and Patterson did so in 1919, and J. O. Anderson and Hawkes nearly did so in 1923. In 1919 Thomas and O'Hara Wood won the world's championship, and in 1922 Anderson and Lycett did so; Lycett, by the by, who learnt his tennis from childhood in Australia, won the world's championship doubles three times in succession with different partners.

In every State save Victoria and Tasmania it is possible to play throughout the year on grass, but in country towns the game is usually played on hard courts. The chief difficulty for the last five years has been to provide enough courts. An arena with nearly 50 courts has been constructed near Sydney—thanks to M. H. Marsh, F. D. McMaster and others—at a cost, when the grand-stands have been constructed, of nearly £70,000; a similar ground of less size has—thanks to Mr. Justice Weigall, N. E. Brookes and others—been provided at Kooyong near Melbourne; another area has been provided in Adelaide, and in Brisbane—thanks to R. D. Frew—there is also a large ground with many courts. In Perth there are many fine grass courts. The municipalities of Sydney and Melbourne are providing on the public parks many courts, which are to be let at a small fee; this example is being followed in the other State capitals and by many suburban municipalities. Games are now played on hard courts at night with electric lighting.

In each State the game is controlled by an association to which clubs are affiliated. Over all is the Australasian Association, which controls the Australian arrangements for Davis Cup matches, the relations between the State associations, and the Australasian championships, and sanctions championships.

The game has in Australia such a hold now that the sway of cricket is seriously threatened. An enthusiast in the north of Queensland travels on his aeroplane 60 miles on Sunday morning to the nearest sheep-station, plays all day and 'planes back at night. The Lawn Tennis Association of Victoria had by the end of December 1923 sanctioned 20 tournaments between Christ-

mas and Easter, and in Sydney the entries for 'country week' totalled 98 teams of men and women (usually six in a team) coming from towns, stations, and selections. Championship contests run from early January till late December; in Sydney inter-club matches have sometimes been played on grass each Saturday for two winters in succession, without one interruption by rain. This development here of a single sport in 40 years results from the genius, or the generosity, of three men—Dwight F. Davis of the United States, who gave the famous cup; Norman Brookes of Victoria; and Anthony F. Wilding of New Zealand. The prowess of Brookes and Wilding in 1908 brought the Davis Cup to Australia, and retained it there, with the assistance of lesser players, until 1919 (but for a short interval in 1913). The contests in Australia and New Zealand for the Davis Cup showed Australians what the game really was, and gave them the desire to excel in it. Credit must also be given to another Australian, Dr. W. V. Eaves, who, having learned all his game in England, came here in 1891 and 1892, defeated all opponents, and taught Norman Brookes the higher points of the game. R.M.K.

Lawry, WALTER (1793-1859), born at Bodmin in Cornwall in 1793, was received into the Methodist ministry at the conference of 1817 and appointed to the Australian mission as assistant to Samuel Leigh (q.v.). He arrived in Sydney on 2 May 1818, and worked with Leigh until 1820 when, the mission having been divided into three circuits, he was given charge of Parramatta. His project for the erection of a chapel there met with some opposition, as some subscribers wished it to be a purely Methodist chapel, whereas others wished to throw it open to any nonconformist minister; consequently he built it in the end largely at his own expense, on a site given him by Governor Macquarie. Meanwhile he had interested himself in missionary work in Tonga, and in 1820 his offer to go to the Friendly Islands was accepted by the committee in London. On 16 August 1822 he reached Tonga with a small party, to be at first welcomed by the natives; but their friendliness was soon replaced by suspicion and distrust, and, after facing many hardships, he re-embarked for New South Wales on 3 October 1823. Returning thence to England, he did circuit work there until 1843, when he was appointed general superintendent of missions in New Zealand and Polynesia. This position he held for 11 years, and then returned to Sydney. He died at Parramatta on 30 March 1859. His *Friendly and Fiji Islands* is valuable for its information on early mission effort in the South Seas.

Lawson, HENRY ARCHIBALD (1867-1922), born at the Weddin Mountain diggings near Grenfell in New South Wales on 17 June 1867, was the son of Peter Hertzberg Larsen—a Norwegian who came to Australia as quartermaster of a Norwegian vessel and, like so many sailors of the time, left his ship to seek fortune on the diggings—and his wife Louisa Albury, of whom an account is given below. After a youth spent in the bush near Mudgee Henry came to Sydney in 1883 and earned his living as a house- and coach-painter, a trade in which employment was often very irregular. In 1887 he was working in Melbourne, in 1889-90 in Western Australia (at Albany), and during intervals he took up-country jobs. At the same time he was experimenting with journalism; he helped his mother with her *Republican* and *Dawn,* and in October 1887 saw his 'Song of the Republic' published in the Sydney *Bulletin,* which thereafter took most of his verses and stories. In 1891 he secured a position on the short-lived Brisbane *Boomerang*; when it failed, he came back to Sydney, and in 1892 undertook for the *Bulletin* a tramp (with spells of work on stations) from Bourke to Hungerford and back. From this trip and his youthful memories Lawson gained his intimate insight into bush life and the qualities and emotions of residents 'out back.'

In 1893 he for a short time edited the *Worker*; the next year he spent in New Zealand; then he was given a post in the office of the New South Wales government statistician—it seems a habit of Australian governments to encourage literature by giving the writer a routine clerkship. In 1894 his first book—*Short Stories in Prose and Verse*—had been published from the *Dawn* office; in 1896 appeared two important volumes, verse in *In the Days When the World was Wide,* prose in *While the Billy Boils*—the latter containing what is probably his best prose work. More travel followed, first to Western Australia, then to New Zealand (where he taught young Maoris in a bush school), then—in 1900-2—to London. After his return to Australia he lived nomadically and wrote profusely, on rare occasions equalling or passing his earlier standard; in a selected edition of his verse published in 1918 70 per cent of the contents date from 1900 or earlier. He never succeeded in sustained efforts; the poems by which he will be remembered—e.g. 'The Sliprails and the Spur'—are short lyrics of highly concentrated emotion; and his best work, which has attained a reputation in Europe, is found in his pre-1900 prose stories. Apart, however, from purely literary considerations, his work gained (and will retain) wide popularity in Australia because of its peculiarly Australian quality. No other writer has so continuously and clearly reflected the souls of his own folk; as David McKee Wright says truly, 'there is not a word in all his work which is not instantly recognized by his readers as honest Australian . . . . he is the first articulate voice of the real Australia.' He died on 2 September 1922. It is understood that his second name 'Archibald' was given him by mistake, the rather deaf minister who christened him having misheard the father's 'Hertzberg.' See LITERATURE.

Lawson's published works (with the dates of their first editions) are *Short Stories in Prose and Verse* (Sydney, 1894); *In the Days When the World Was Wide* (Sydney, 1896); *While the Billy Boils* (Sydney, 1896); *On the Track and Over the Sliprails* (Sydney, 1900); *Verses, Popular and Humorous* (Sydney, 1900); *Joe Wilson and His Mates* (London, 1902); *Children of the Bush* (London, 1902); *When I Was King* (Sydney, 1905); *The Rising of the Court* (Sydney, 1910); *The Skyline Riders* (Sydney, 1910); *For Australia* (Melbourne, 1913); *Triangles of Life* (Melbourne, 1913); *My Army, O My Army* (Sydney, 1915). A volume of *Selected Poems,* containing his best work in verse, was published in Sydney in 1918, and a definitive edition of his verse in three volumes in 1925.

Lawson, LOUISA (1848-1920), born at Guntawang near Mudgee in 1848, was the second child of Henry Albury, a Kentishman with gypsy blood in his veins who was successively shearer, carter and timber-getter in the Mudgee district. At the age of 18 she married Peter

Larsen, and they moved to Grenfell in the hope of winning gold on the diggings there, after a year returning to Eurunderee in the Mudgee district and settling there on a selection. The poverty of the land and the droughts of the early eighties drove the family to Sydney, while Peter Lawson (as he was by then called) found work near Rylstone and afterwards near Hartley. Louisa Lawson, after a short venture in boarding-house-keeping, determined to devote herself to journalism. In 1887 she bought a journal named *The Republican* and trained her son Henry to edit it, but in the following year embarked on a new venture—*The Dawn*—a journal edited, printed and published by women, in which for 17 years (May 1888 to July 1905) she upheld the feminist cause. In 1905 she published at the *Dawn* office *The Lonely Crossing and Other Poems* (2nd edition, 1909). It was through her zeal that the insignificant wooden cross at first placed on the grave of Henry Kendall in Waverley cemetery was replaced by a monument more worthy of him. In 1898 she founded the journal *Young Australia*. She died at Sydney on 12 August 1920.

Lawson, WILLIAM (1774-1850), born on 2 June 1774 at Finchley near London, on 20 June 1799 joined the New South Wales Corps as ensign, and in 1800 reached Sydney with a detachment of the corps and was sent to serve on Norfolk Island, where he ran a small flock of sheep. By 1806 he was back in Sydney, and on 14 November was promoted lieutenant; he sat on the court martial that tried D'Arcy Wentworth (q.v.) in 1807, and the criminal court that Bligh assembled to try John Macarthur in January 1808, became Johnston's aide-de-camp after the mutiny, and at the end of the year was appointed commandant at Newcastle. Here he came into collision with Henry Browne Hayes (q.v.), who sided with Bligh, had been exiled to Newcastle therefor, and was issuing pasquinades against the provisional government. When Macquarie arrived, Lawson was sent to England with the corps and summoned to attend the trial of Johnston, who regarded him as an important witness; but in April 1811, before the trial came on, he and two other officers of the corps managed to secure a passage back to New South Wales in the *Admiral Gambier*, and obtained appointments in Macquarie's new 'veteran corps' formed out of New South Wales Corps men who wished to settle in the colony. It would seem that Lawson—whose principal interest from the first was farming—had followed Johnston in the mutiny purely as a matter of discipline, and was not considered by the authorities to have been influenced by those personal motives that undoubtedly swayed Macarthur and others.

Lawson now retired to Veteran Hall, on his property at Prospect, but in 1813 joined Gregory Blaxland in his successful attempt to find a way across the Blue Mountains (see EXPLORATION BY LAND). In this journey Lawson was the surveying expert, and his journal (preserved in the Mitchell Library at Sydney) records times and distances with such minute detail that the explorers' course can be laid down hour by hour on a map. For his services he received a grant of 1000 acres, which he located on Campbell's River near Bathurst; and in August 1819 Macquarie made him commandant of the settlement there, describing him later as 'a most meritorious and useful officer.' During his tenure of this office he devoted a great deal of time to exploration, and in at least three journeys in 1821-2 opened up the district of Mudgee, and a track from Bathurst northwards to Mudgee and right through to the Goulburn River. In the Mudgee district he gradually accumulated large properties, extending to the Talbragar River. Brisbane in 1825 described him as 'one of the most extensive Land and Stock owners in the colony . . . . a reasonable and not illiberal man.' In 1824 he resigned his post at Bathurst and retired to Prospect, where he spent the rest of his life, dying there on 16 June 1850. The discovery of the Mudgee district has often been attributed to him: but he himself gave the credit for it to James Blackman, chief constable at Bathurst, on whose information both Lawson and the Cox brothers hastily opened up the district and secured the best of the land.

It has usually been assumed that Gregory Blaxland was the originator and leader of the expedition that first crossed the Blue Mountains, and the weight of evidence still favours that assumption; but notice must be taken of a claim, put forward in 1827, that Lawson devised the method of penetrating the tableland by keeping along its highest points. The anonymous author of 'A Ride to Bathurst' in the issue of *The Australian* for 13 March 1827 asserts that Lawson frequently discussed the problem with his unsuccessful precursor George Caley; in the end he made up his mind to attempt a crossing along the summit-levels, foreseeing 'that the timber and scrubby underwood would there be thinnest, and that a long continuous flat or table land would offer much smaller impediments' than the previously tried routes up the valleys. So, the anonymous author continues, Lawson 'secured an agreeable companion in Mr. William Wentworth, and a persevering assistant in Mr. Gregory Blaxland,' and achieved the passage. Although several other assertions in the 'Ride to Bathurst' were promptly challenged, this was not. But Gregory Blaxland had left for England a month earlier, and it was no one's business to interfere on his behalf. Lawson, who was living at Prospect Hill, did not trouble to disclaim the assertion.

Blaxland himself states positively that he devised the plan, was asked by Macquarie to carry it out, and invited Lawson and Wentworth to join him (see his letter to John Oxley Parker which prefaces the *Journal of a Tour of Discovery*). The *Sydney Gazette* of May 1813 mentions Lawson first in its paragraph relating to the expedition: on the other hand, Macquarie in his general order and despatch invariably mentions Lawson last of the three. Until further evidence comes to light the anonymous assertion of 1827 cannot outweigh Blaxland's of 1823; but its fulness of detail entitles it to consideration.

Lawyer Vines. See LILIACEAE.

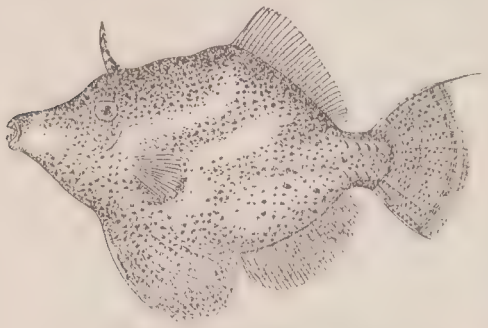
Leaf-insects. See STICK-INSECTS AND LEAF-INSECTS.

Leather-head. See FRIAR-BIRDS.

Leather Jacket. See RHAMNACEAE.

Leather-jackets, members of the family Monacanthidae which occur in all temperate and tropical seas, but are more plentiful in Australia than elsewhere. As is indicated by their vernacular name, they are protected by a tough skin beset with countless minute prickles. A strong spine above the head can be erected, and locked in position by bony structures at its base,

thus becoming a valuable protection against larger enemies that might wish to swallow the fish. Leather-jackets are well known to fishermen on account of their habit of nipping lines through with their sharp teeth; these are remarkably compressed, and so disposed towards one another as to form beak-like structures in the jaws. Their colours are often of great beauty; when the fish are first captured, lines



Fan-bellied Leather-jacket (*Monacanthus chinensis*).

and spots of opalescent green and blue scintillate during their convulsive death-throes, but disappear within a few minutes. Leather-jackets are good eating after the tough skin has been removed. They are often attacked by a large crustacean parasite, which bores under the skin, and eats away the living flesh.

The Monacanthidae and allied families are peculiar among fishes in their use of the dorsal and anal fins. In most fishes these serve merely for balancing, the tail alone being used for propulsion. But in the leather-jackets an undulating, wave-like motion of the dorsal and anal fins serves to move the fish forward, and the tail, in leisurely movement, serves only as a rudder.

A. R. McC.

Leeches, vernacular name of the Hirudinea, a class of worm-like animals usually classed among the chaetopods or bristle-worms (q.v.), widely distributed in all parts of the world, and frequenting both fresh and salt water as well as the land. Of land and freshwater leeches several interesting species are found in Australia; of the former there are two genera, *Philaemon* and *Geobdella*—the first represented by *P. pungens*, which is peculiar to Australia and Tasmania; of the second *G. australiensis* and *G. Whitmani* are Australian and *G. tristriata* is found in New Guinea. They are voracious creatures, lurking among dead leaves and under logs, and eagerly attacking man and other animals. *P. pungens*, however, roams freely about in the scrub, attaching itself adroitly to the ankles of unwary wayfarers, where it gorges itself with blood before dropping off. Its egg-capsules are light-brown spherical objects about one-third of an inch in diameter, whose surface is covered with a peculiar honeycomb-like projecting netting; they are commonly found under logs.

Among freshwater leeches two genera, *Dineta* and *Semilageneta*, are not found elsewhere; the cosmopolitan genera *Glossiphonia* and *Hyperobdella* also occur. The largest of our species, *Limnobdella australis*, is used for medicinal purposes.

See *Proceedings* of the Linnean Society of New South Wales, 1909-1910. T.S.

Leeper, Alexander, born at Dublin on 3 June 1848 and educated at Trinity College, Dublin (B.A., 1871; M.A., 1875; LL.D., 1884) and St. John's College, Oxford (1st class in classics, 1874), in 1875 migrated to Melbourne and in the following year was made warden of Trinity College within the local university. Elected in 1880 to the university council, he resigned in 1887, but was re-elected in 1900. Under his direction were produced the first Latin (*Mostellaria*) and the first Greek play (*Alcestis*) ever staged in Victoria, and in 1896 he staged *Strafford*, the only play by Robert Browning that has been produced outside the mother-country and the United States. His services to classical study in Australia have been great, and he was the founder and first president of the Victorian Classical Association. In 1918 he resigned his wardenship and retired into private life, diversified with a lay canonry of the Anglican cathedral and the chairmanship of trustees of the public library.

Lee Steere, Sir James George (1830-1903), born in 1830 in Surrey, England, was 3rd son of Lee Steere, once member for that county. Migrating to Western Australia in 1860, he became a pastoralist, and in 1868 a nominee member (unofficial) of the old legislative council, of which he was speaker from 1886 to its dissolution in 1890. In that year he was elected to the new legislative assembly, and became its speaker—an office which he held till his death. He took great interest in federation, representing his colony on the federal council in 1886-8-9, and attending as delegate the conference of 1890 and the convention of 1891. He died on 1 December 1903. (Kt. Bach., 1888; K.C.M.G., 1900.)

Lefroy, Sir John Henry (1817-1890), born in Hampshire on 28 January 1817, passed into the royal military academy at Woolwich in 1831 and in 1834 was gazetted second lieutenant in the artillery (lieutenant, 1837; captain, 1845; lieutenant-colonel, 1855; brevet-colonel, 1858; brigadier-general, 1864; major-general, 1868; lieutenant-general, 1877; general, 1882). His military activities were great and useful. He was the first secretary of the royal artillery institution, compiled a handbook of field artillery that was much used during the Crimean war, became scientific adviser to the war minister in the same war (being the first to recommend the use of rifled ordnance), and gained the friendship of Florence Nightingale during a mission to Constantinople; after the war he reorganized the staff college at Sandhurst, initiated the school of gunnery at Shoeburyness, reported on the British fortresses in the Mediterranean, worked on the ordnance select committee (secretary, 1860; president, 1864), and in 1868 was appointed director-general of ordnance. Resigning in 1870, he was next year made governor of the Bermudas (1871-7), and subsequently acted for a year as governor of Tasmania (1880-1). Throughout his life he was keenly interested in magnetic science, and from 1839 to 1853 was entrusted with special observational work of this kind, first at St. Helena (1840-2), and afterwards at Toronto in Canada. His observations during an expedition into north-western Canada (1843-4) 'remain the chief authority for the determination of the approximate position of the forces of magnetic intensity in North America' (*D.N.B.* xi. 841). While in Tasmania he returned to this subject with

a paper read before the local Royal Society, 'On the Magnetic Variation at Hobart.' Returning to England in 1882, he died in Cornwall on 11 April 1890. (C.B., 1870; K.C.M.G., 1877.)

Leguminosae, a very large and widespread family of plants. In number of species it is the second among flowering plants in the world; among those of Australia it is first, being represented by 1276 species of great variety of form and very widely distributed. The family, whose salient character is the seed-pod or legume, is divided into three main groups:
(I) Papilionaceae, or butterfly flowers (e.g. the Darling pea, Sturt's desert pea and the garden bean), containing the majority of pea-flowered genera;
(II) Caesalpineae, having irregular flowers with spreading petals (e.g. the cassias);
(III) Mimoseae, having numerous small flowers combined in a head or spike (e.g. the acacias).

Sphaerolobium is a genus endemic in Australia (and chiefly confined to Western Australia) of small shrubs with rush-like stems, frequently leafless. *S. vimineum* grows in tangled masses, usually in swampy stations; the interlaced wiry stems carry on their tips numerous clusters of small flowers. The small pods (about 2 lines in diameter) are nearly globular. *Daviesia,* also endemic, has small yellow, orange, or red flowers, flattened triangular pods and rigid, more or less spiny leaves. Other endemic genera are *Pultenaea, Goodia* and *Barklya.*

Pultenaea is a large genus of shrubs with opposite or whorled leaves, flowers usually yellow, frequently marked with purple, collected into leafy heads; *P. daphnoides* and *P. flexilis* are ornamental shrubs, easily grown from seeds. *Goodia* comprises shrubs with leaves divided into 3 leaflets (as in trefoil), and large yellow flowers with a purple base; *G. lotifolia,* occasionally called clover-tree, is reputed to be poisonous to stock. *Barklya* consists of a single species, *B. syringifolia,* a handsome tree, largely grown as an ornamental garden-plant. Its leaves are simple, broadly heart-shaped; flowers small, bright golden yellow, in dense narrow spikes; pod flat, the valves thin. It has a close-grained timber of a blackish-grey colour.

Peltophorum is a small tropical genus of tall trees with yellow flowers; the Australian species, *P. ferrugineum,* has a blackish timber much in request for cabinet work.

See Acacia, Albizzia, Bauhinia, Bossiaea, Canavalia, Caesalpinia, Cassia, Castanospermum, Clianthus, Crotalaria, Derris, Dillwynia, Erythrina, Gastrolobium, Gompholobium, Hovea, Indigofera, Jacksonia, Kennedya, Lotus, Mirbelia, Mucuna, Oxylobium, Psoralea, Sesbania, Sophora, Tephrosia, Trigonella, Vigna, Viminaria.

Le Hunte, Sir George Ruthven, was born in Wexford county, Ireland, on 20 August 1852, educated at Eton and at Trinity College, Cambridge (B.A., 1873; M.A., 1880), and admitted a barrister of the Inner Temple in 1881. He was for some time private secretary to Sir Arthur Gordon, the first governor of Fiji, and in 1875-87 served in various offices in that colony; in 1883 he was judicial commissioner on the high commission for the western Pacific. In 1887 he was transferred to the West Indies to be president of Dominica; from 1894 to 1897 he was colonial secretary of Barbados, and for a short time in 1897 was colonial secretary of the Mauritius. In 1898 he was chosen to succeed Sir W. MacGregor as lieutenant-governor of British New Guinea, and for five years administered the protectorate with a genial impulsiveness that sometimes troubled his subordinates greatly. On 1 July 1903 he was transferred to the governorship of South Australia, and left Australia at the end of 1908 to take up the governorship of Trinidad and Tobago—a position in which his administrative talents and knowledge of tropical conditions had more play than at Adelaide. He retired from the public service at the beginning of 1916. (C.M.G., 1898; K.C.M.G., 1903; G.C.M.G., 1912.)

Leichhardt, Friedrich Wilhelm Ludwig (1813-1848), was born at Trebatsch (a village 45 miles SE. of Berlin) on 23 October 1813, studied at Gottingen and Berlin, and with William Nicholson of Clifton travelled in France, Italy, and England. Having evaded military service and been proclaimed a deserter, he migrated in 1841 to New South Wales, and for two years investigated the petrology and botany of the Moreton Bay district, forwarding numerous fossils to Professor Owen in England. The results of his labours appeared in several German scientific periodicals and in Owen's reports to the British Association in 1844. An expedition to explore the northern parts of Australia having been projected, Leichhardt applied for the position of naturalist; but the delays disappointed him, and by means of private contributions and his own resources he succeeded in equipping an expedition, the story of which (and of his later explorations) is told under Exploration by Land.

The most remarkable feature of his first expedition was that it reached any destination at all. Ernest Favenc, himself an explorer, describes Leichhardt as 'a man whose character, to judge from his short career, was largely comprised of contradictions and inconsistencies. Eager for personal distinction, with high and noble aims, he yet lacked that sympathy and feeling of comradeship that attracts men. Leichhardt's followers never desired to accompany him on a second expedition . . . . The journal of the trip reads to a man accustomed to bush life like the tale of the Babes in the Wood, yet he managed to blunder through.' On his last expedition, however (that of 1848), his luck failed him, perhaps because his companions were less experienced bushmen than usual. He wrote cheerfully on 4 April from a camp on the Cogoon River Muckadilla Creek), and then vanished into the unknown western region. No authentic trace of him has ever been discovered; but endeavours to find him were responsible for A. C. Gregory's explorations of 1855-6. Before he died the King of Prussia had pardoned him, at the request of Alexander von Humboldt, for desertion, and given him permission to return to Prussia; but it is uncertain whether the pardon ever reached its destination.

Leichhardt's Tree. See Morinda.

Leigh, Samuel (1785-1852), born of Anglican parentage at Milton in Staffordshire on 1 September 1785, while still young attended Methodist cottage services, and after a time joined the Independent congregation at Hanley. Responding to a call for workers on the mission-field, he commenced the study of theology under Dr. Bogue of Gosport, one of

the founders of the London Missionary Society, with whom he agreed to remain for three years. At the end of the first year, however, he left; Bogue was a Calvinist, and Leigh an Arminian, and their theology would not harmonize. Joining the Methodist Society at Portsmouth as assistant to Joseph Sutcliffe, Leigh met Dr. Coke, the great missionary, then on his way to Ceylon. After labouring at Shaftesbury for two years, he was accepted by the Methodist conference of 1814 for mission work, and nominated to North America; but the Canadian Methodists thought it wiser in that disturbed year to do without a missionary, and Leigh was transferred to New South Wales. When on 3 October he had received ordination from the hands of Dr. Adam Clarke and others (having already on 30 September taken the necessary oaths before the Lord Mayor of London), Lord Sidmouth sanctioned his departure for New South Wales, but (curiously enough) does not seem to have consulted Lord Bathurst, the secretary for the colonies; consequently, when Leigh reached Port Jackson, Macquarie felt bound to report to Bathurst that he had arrived 'without any letter or pass from your lordship's office,' and went on to recommend 'that no persons of his description should in future be permitted to come out.' He had no personal objection to Leigh, but did not want 'sectaries' in a new and rising colony. Bathurst sympathized, and, while authorizing Leigh's residence in the colony 'so long as he shall continue to conduct himself with propriety and decorum,' promised to use great caution in sanctioning the admission of other 'sectaries.'

Leigh sailed in the *Hebe* on 28 February 1815, at the cost and under the direction of the Wesleyan Missionary Society, to which he held himself entirely responsible. On arrival in Sydney (11 August) he waited on Macquarie and on the government chaplains—Marsden, Cowper, and Cartwright. Macquarie was not inimical: Leigh, he reported seven months later had 'conducted himself very quietly and inoffensively;' his personal regard for Leigh grew steadily, and his support was constant and valuable. The chaplains, for their part, received him readily and helped him consistently. He held his first service in a house in the Rocks quarter of Sydney, and went on to organize Methodism in Sydney, Castlereagh, Parramatta, Liverpool, and the settlements on the Hawkesbury (where he preached in a wooden skillion); he also at Macquarie's request visited Newcastle. Not long after his arrival in Sydney he founded a Benevolent Society which, Macquarie having given it a building, became 'The Sydney Asylum for the Poor' and in 1818 the Benevolent Asylum; this was one of the earliest examples of joint effort among the denominations, William Cowper and Robert Cartwright (both Anglican chaplains) joining Leigh in the establishment of the asylum, and Bathurst refusing in spite of strong pressure to make it a denominational institution. In 1818 Leigh, whose health had suffered greatly from privations, persuaded the missionary society to send out William Lawry (q.v.) to his help; he then visited New Zealand (where he stayed nine months), went back to England in 1820, and on his return to Australia in 1821 established a mission at Hobart. In February 1822, at Marsden's suggestion, he went again to New Zealand, where he founded the Wesleyan mission at Whangaroa. Leaving New Zealand in September 1823 in the *Brompton*, he was wrecked on a lonely island and suffered great privation for three days. He again took up work in Parramatta, but not for long; then, returning to England, he continued in circuit work till 1845, when he retired to Reading. While advocating the interests of the Australian mission, he was seized with paralysis, from which he died on 2 May 1852, at the age of 66.

Though not possessing great intellectual power, Leigh was a true missionary, with the earnestness of an apostle. He opened at Castlereagh the first Methodist chapel in Australia; he assisted at the opening ceremonies of Princes-street and Macquarie-street chapels; he rendered valuable help in the formation of a branch Missionary Society, a Tract Society, and a Bible Society. The theological college at Enfield and the Macquarie-street church at Parramatta are named in his honour.

Strachan's *Remarkable Incidents in the Life of the Revd. Samuel Leigh*, published in London in 1855, is the principal authority for Leigh's doings. An account of his New Zealand mission will be found in Buller's *Forty Years in New Zealand*.

Lemons. See FRUIT-GROWING.

Lennox, DAVID (1788-1873), born at Ayr in Scotland in 1788 and trained as a stonemason, was employed until he was 44 on various bridge-building jobs in England, including the masonry of the famous Menai bridge, some of the London bridges, and the construction of a large number of wooden bridges for the government across the Gloucester-Berkeley canal. He was also foreman builder on the stone bridge at Gloucester, of 150-feet span, which Telford had adapted from one of the arches of a remarkable bridge by Perronet over the Seine at Neuilly in France. The unusual design of the Gloucester bridge stuck in Lennox's mind, and several of his best works in Australia are patterned on it.

In 1832 he migrated to Sydney, which he reached on 11 August, and at once took employment as a stonemason on government work. Here almost immediately Major Mitchell, surveyor-general, then much exercised over the poor condition of most bridges in the colony (they were nearly all wooden, and many had been damaged by fire or flood), found him and engaged him as bridge-engineer. (It is probable that Lennox had sent in his testimonials to Mitchell already, but had not awaited a reply before finding work.) Mitchell was enthusiastic about him, and Bourke, with whom the appointment lay, on 1 October made him sub-inspector of roads and superintendent of bridges, with apologies to the colonial office for having appointed a 'practical' man instead of an assistant-surveyor of the type previously supplied from England. Lord Stanley, however, the then secretary of state for the colonies, approved highly of the change; and 'thus,' said Mitchell 23 years later, 'originated all the bridges this colony possesses worthy of the name.' Among them should be noted the Lapstone bridge on the first slope of the Blue Mountains (1833), with a semi-circular arch; the Lansdowne bridge over Prospect Creek on the main southern road, opened in 1836—built on the Neuilly pattern, with a span of 110 feet; the Lennox bridge at Parramatta, an 80-feet span, also of the Neuilly type, completed in 1839; and several smaller stone and wooden bridges over creeks intersecting the main roads to Goulburn and Bathurst. In 1837 Mitchell's department of roads was transferred to the care of a detachment of royal engineers, and Lennox seems to have been at a loose end for some years; in 1839-41 he was building St.

Andrew's Presbyterian church at Parramatta, and in 1843 was made district surveyor to the Parramatta district council. But in 1844 Gipps appointed him superintendent of bridges at Port Phillip for the special purpose of bridging the Yarra, and in 1845 he was entrusted with the construction of a bridge of 150-feet span, again of the Neuilly type, which on 15 November 1850 was formally opened and named 'Prince's Bridge.' The three New South Wales bridges already mentioned are still in use, but Lennox's Yarra bridge had to be demolished in 1884, when the river channel was considerably widened. During his term of duty in Victoria, which lasted till November 1853, Lennox not only designed and built more than 50 bridges, but was in charge of all the construction of roads, wharves and jetties in the Port Phillip district. Having worked all his life on an inadequate salary (Bourke gave him £120 a year, and afterwards £200; Gipps gave him £250, and the Victorian government when it came into existence made the salary £300), he had no savings to retire on, and was granted by the Victorian council £3000—the first adequate acknowledgment of his services. He returned in 1855 to Parramatta, and lived there quietly until his death on 12 November 1873.

The only trustworthy account of Lennox's life, written by Henry Selkirk, was published in vol. vi, part v, of the Royal Australian Historical Society's *Journal*, and from it this account has been summarized.

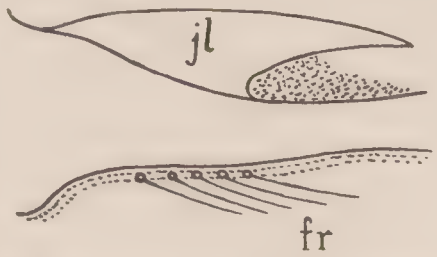
Leopard Tree. See FLINDERSIA.

Lepidoptera, a very large order of insects, abundantly represented in Australia; about 7900 species have already been described, of which 334 are butterflies, the rest moths. Many hundreds of new species still await description. All illustrations referred to in the text will be found on plate ix.

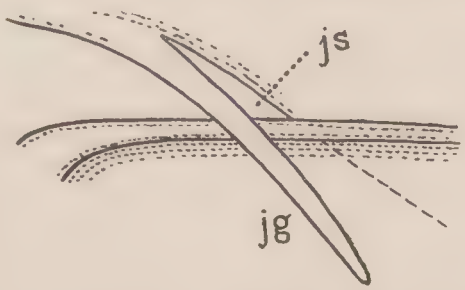
The order as a whole is characterized by the presence upon the wings of scales (modified hairs), in which are deposited the pigments that give the wings their brilliant colours and intricate patterns. The wing-venation is characterized by the elimination, in all but the lowest forms, of the main stem of the media, leaving the wide basal cell as a clear area between the radius and cubitus. The mouth-parts, originally of the mandibulate type still preserved in the lacewings and their allies, have become secondarily evolved to a sucking (haustellate) type, the galeae of the two maxillae becoming elongated to form a sucking-tube; this in some of the higher forms, such as the hawk-moths, becomes immensely long and is carried rolled up in a closed spiral. The larva is a caterpillar, normally with three pairs of thoracic legs and five pairs of abdominal prolegs (claspers), inclusive of the anal pair. The pupa, often called a chrysalis, is usually of the type known as a *pupa obtecta*, but in some cases is a *pupa incompleta*, with greater capacity to move its segments freely. It is often enclosed in a silken cocoon.

The subdivision of the order into butterflies (Rhopalocera) and moths (Heterocera) has long ago been discarded by men of science. In this article a more natural subdivision will be adopted.

In the sub-order Homoneura the venation of the fore and hind wings is similar, each wing having 12 veins ending on the margin, exclusive of the anals. The wings are coupled together loosely in flight, the fore-wing possessing either a fibula or jugal lobe (Micropterygidae)



Jugal lobe and frenulum in Micropterygidae.

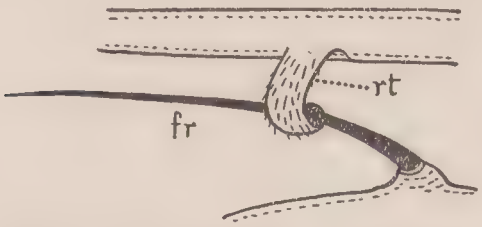


Jugum in Hepialidae, depending from fore-wing so as to grasp costa of hind-wing in jugal sinus.

or a true jugum, which is believed to form a finger-and-thumb clasp for the base of the costa of the hind-wing (Hepialidae). The very archaic little moths known as Micropterygidae, though abundant in New Zealand, are only represented by two species in Australia, the better-known one being *Sabatinca calliplaca*, from Mount Tambourine. Another species (*Anomoses hylecoetes*), originally described as belonging to this family, is now placed in a second family Anomosetidae, while the recently described *Palaeoses scholastica* forms the sole existing representative of the Palaeosetidae. Both these families are related to the Hepialidae.

The Hepialidae (swifts or wood-moths) have their headquarters in Australia, and are represented by a number of very large and handsome forms. The most striking is *Leto staceyi* (Bentwing Moth, fig. 14); the female of this moth expands up to ten inches. There are also a number of large species belonging to the genus *Charagia*, with green or pale blue fore-wings and white or rose-pink hind-wings. *C. ramsayi* is fig. 15. The larvae are wood-borers in the stems of *Eucalyptus, Acacia*, etc. The pupa is incomplete, and much resembles the pupa of the crane-flies. A number of less showy species, whose larvae feed on the roots of trees and grass, are contained in the genera *Pielus, Trictena, Porina, Perissectis, Oncopera* and *Hectomanes*.

In the sub-order Heteroneura the venation of the hind-wing differs from that of the fore, being reduced to eight veins at the most, exclusive of the anals. This is brought about by a distal fusion of Sc with R_1, and by the suppression of all the branches of Rs. The wings are either coupled in flight by means of a frenulum fitting into a retinaculum on the under-side of the fore-wing, or are kept in position simply by the overlapping of the dorsum of the fore-wing upon the enlarged costal area of the hind, as in



Frenulum and retinaculum in Heteroneura (males). In most females the frenulum consists of a number of bristles.

butterflies (q.v.) and emperor-moths (amplexiform types).

The most archaic family is the Cossidae, which, apart from the striking difference of venation, show considerable affinity with the Hepialidae. They are represented in Australia by 36 species, many of great size. The enormous *Xyleutes affinis*, with a wing-expanse reaching up to nearly 10 inches, and a huge cumbersome body as big as a small banana, is probably the heaviest moth in the world. The larvae of this family are wood-borers, mostly in large forest trees.

The peculiar family Castniidae is represented by about 25 species belonging to the genus *Synemon*. They are day-flying moths with clubbed antennae, and thus superficially resemble butterflies. But they possess a frenulum, and their venation is very archaic and quite unlike that of the butterflies. The imagines fly over grasslands, but nothing is known of their life-histories.

The super-family Tortricoidea (500 species) comprises several families of small moths related to the Cossidae, but somewhat more specialized. The dominant family Tortricidae (bell-moths) is well represented here by nearly 300 species. Many of these are exceedingly beautiful, as are some species of lesser-known families, such as *Bondia caseata* (fig. 16) belonging to the Carpocapsidae.

The super-family Tineoidea comprises about 3400 of the known Australian species, mostly small moths. The Oecophoridae, however (1500 species), contain some beautiful species, one of which, *Wingia lambertiella*, is fig. 17. The family Xyloryctidae (nearly 300 species), of which *Xylorycta porphyrinella* (fig. 18) is a fine example, have wood-boring larvae, some very destructive to fruit-trees. The Aegeriidae (clear-wings) are not well represented in Australia, but the small and delicately fringed Gracilariidae are more numerous. Quite a number of showy species belong to the Hyponomeutidae. The family Tineidae (400 species) contains small moths distinguished by the hairiness of their heads; the larvae of many of these latter (e.g. the genus *Xysmatodoma*) make cases which they carry about with them, like those of the Psychidae and caddis-flies. The Gelechiidae are extensively represented, more than 400 species being known.

The super-family Zygaenoidea contains four families found in Australia—the Psychidae (case-moths), the Limacodidae (cup-moths), the Epipyropidae, and the Zygaenidae (burnet-moths). About 25 species of Psychidae are known here, the largest being *Metura elongata*. The bags or cases formed by the larvae are often of elaborate structure and great interest; but the moths themselves are usually ugly, the females being wingless and never leaving their cases, while the males, which are much smaller, have wings poorly supplied with scales, and dash themselves about in the wildest manner as soon as they emerge. The Epipyropidae are an obscure group whose larvae feed upon plant-hoppers.

The Limacodidae are remarkable for their hard oval cocoons, which are neatly opened by the emerging moth, the empty cocoon resembling a cup. The larvae are slug-like, but beautifully coloured; many of them possess a series of urticating tubercles for defence. Our commonest species is *Doratifera longerans*, in which the sexes are very dissimilar in size and coloration. One of the prettiest of this family is *Monopla miltogramma* (fig. 19). Thirty-five species are known from Australia.

The Zygaenidae or true burnet-moths are not well represented in Australia, there being only 16 small species of bright green or velvety black coloration, resembling the forester moths of England. The place of the more typical and showy spotted burnets is taken by the Syntomidae, a specialized offshoot from the Arctiidae, discussed later on.

In the super-family Pyraloidea, the archaic family Thyrididae is represented by nearly 50 species, those of the genera *Rhodoneura* and *Addaea*, found in Queensland, being the best-known. The group of closely allied families Pyralidae, Pyraustidae, Crambidae, and Phycitidae are exceptionally abundant, there being nearly a thousand species, many of graceful shape and beautiful coloration—as may be seen from the two species figured, *Margaronia suralis* (fig. 28) and *Hyalobathra minialis* (fig. 29). One of the commonest is the prettily marked *Zinckenia recurvalis*, whose larvae feed upon saltbush. The aquatic caterpillars of the genus *Hydreuretus* are quite common in Australian rivers. They build cases out of reeds, and carry them about in the manner of caddis-worms. They breathe by means of filamentous gills thrown out from all parts of the abdomen. Little is known of the Australian species. The plume-moths (Pterophoridae and Orneodidae) are somewhat rare in Australia, only 36 species being known, of which six belong to the latter family or 'twenty-plumes.'

All the above represent the more archaic types of Heteroneura. We now come to the more specialized types, in which the cell is always completely formed, and the hind-wing has only two free veins below the cell.

The Lasiocampidae (eggars, lappets) are a very distinct family of which about 40 species are known from Australia. They are mostly grey or brown in colour, and have projecting palpi; our best-known genus is *Entometa*.

In the super-family Noctuoidea are included a number of allied families represented by nearly 1300 species in Australia, of which nearly 900 belong to the dominant family Noctuidae. Many of these latter are serious pests, their caterpillars (cutworms) destroying the roots of grass or vegetables wholesale. The most noteworthy species is the famous Bugong or Bogong Moth (*Agrotis spina*) which often appears in immense swarms in October, hiding in houses, where they may even blacken the ceilings and crawl into every corner and into the folds of garments. They also swarm in crevices of rocks and on the summits of mountains, where the aborigines used to search for them, sweeping them up in thousands and making them into a paste for food. Another large house-haunting noctuid is *Sericea*

spectans, mottled blackish with large eyespots on the wings; *Dasypodia selenophora* is a similar species found in Victoria. The fine moths of the genus *Ophideres* occur commonly in Queensland, where they suck the juices of citrus fruits and bananas. There are many handsome species of noctuids, particularly among the sub-alpine forms. The prettily marked *Fodina sarmentosa* is fig. 25, and the widely-spread tropical species *Paracrama dulcissima* fig. 24. The day-flying moths of the sub-family Agaristinae are known for their conspicuous colour-patterns. The most beautiful of these is the gaudy *Agarista agricola,* while the commonest and most destructive is the Vine Moth, *Phalaenoides glycinae.* The extraordinary Whistling Moth, *Hecatesia fenestrata,* has a peculiar zigzag flight at sunset, and the male makes a whistling noise, supposed to be caused by friction between the antennae and a clear membranous patch on the fore-wings.

The Drepanidae (hook-tips) are rare in Australia, only three species being known. The Lymantriidae (tussock moths), are much more numerous, 60 species being known. Most of these are grey, brown or fawn-coloured, without any special pattern. The Anthelidae include the fine genus *Chelepteryx,* with two very handsome species, one of which, *C. collesi,* reaches six inches in expanse. The larvae of this genus are solitary. Those of most of the Lymantriidae build large shelters in trees or bushes, in which they live gregariously. Their hairs, which are usually urticating, are spun into the fabric of their cocoons, thus making them dangerous to handle.

The small family Hypsidae connects the Noctuidae with the Arctiidae. Several common species occur, notably the day-flying black-and-white moth, *Nyctemera amica.*

The Arctiidae (tiger-moths, footmen) are abundant in Australia, with about 170 described species, mostly of the sub-family Lithosiinae or 'footmen.' Most of these are beautifully coloured in red or orange. Two examples are figured, *Castulo doubledayi* (fig. 21) and *Scoliacma bicolor* (fig. 22).

The Syntomidae (false burnet-moths), already mentioned when discussing the Zygaenidae above, are a specialized offshoot of the Arctiidae, their larvae being lichen-feeders. The adults are mostly black, with pink or orange spots, and closely resemble the true burnets in appearance, as may be seen from the figure of the common *Amata annularia* (fig. 23).

The Notodontoidea include two families, Notodontidae and Sphingidae. The first of these contains two sub-families. The Cnethocampinae include the processional moth *Ochrogaster contraria,* whose larvae may often be seen crossing a road in single file, two or three hundred at a time. Of the Notodontinae (prominents) about 70 Australian species are known, notably the large species of the genus *Hyleora,* whose smooth, green caterpillars feed on the foliage of eucalypts. The spotted white *Cerura australis* also belongs to this family. The Sphingidae (hawk-moths) are represented by about 50 species, many common, but most of them rare and striking forms, chiefly found in the tropics. In eastern Australia the gigantic *Coequosa triangularis,* beautifully marked in orange and brown, is one of the largest hawk-moths known; the female often expands over seven inches. *C. australasiae* is even more beautiful, but not quite so large. Both species are greatly prized by collectors. In Queensland there are to be found a number of species of the day-flying 'humming-bird hawk-moths,' with clear wings and tufted tails, belonging to the genera *Macroglossum* and *Cephonodes.* In *Cizara ardenia* (fig. 20), one of the most striking of the Australian hawk-moths, the combination of a rich, glossy, greenish-black ground-colour with delicate pink markings is unusual.

The super-family Geometroidea (loopers) is named from the well-known manner of progression of the caterpillars, which have only a single pair of pro-legs besides the anal claspers. Nearly 1000 species have been described from Australia. Of these, the Oenochromidae (Monocteniidae), the thorn-moths, include nearly 200, most of them very handsome species. The Boarmiidae (Selidosemidae) contain nearly 300 handsomely marked grey or brown species, with wavy bands on their wings, many being of considerable size. Their larvae, which are common objects in the bush, resemble short twigs or sticks. The Larentiidae (wave-moths) are smaller, often beautifully coloured or patterned with delicate tracery, especially the mountain species. The Geometridae or emerald moths are the most beautiful of all, and are well represented in Australia by 130 species. Two are figured, *Agathia laetata* (fig. 26) and *Uliocnemis partita* (fig. 27).

The Uranoidea contain only the two families Epiplemidae and Uraniidae. The former family includes small moths which, when at rest, twist their fore-wings into a roll, and mimic the attitude of a jumping spider. The Uraniidae are large day-flying moths, confined to the tropics. Superficially they resemble swallow-tail butterflies. Our commonest spieces, *Alcidis zodiaca,* is sometimes found in swarms resting on vines in the tropical scrub.

The Bombycoidea contain only two families, Bombycidae and Saturniidae, of which the former family is represented in Australia by four species only. The Saturniidae (emperor moths) are represented by eight large and handsome species, the commonest being *Antheraea cucalypti.* The caterpillar of this moth is spiny and very handsomely coloured, and is frequently found feeding on eucalypts. The largest species is the magnificent *Coscinocera hercules,* found only in northern Queensland and Papua. Measuring up to 10½ inches in expanse, this is probably the largest moth in existence.

Butterflies form a very distinct group, and are dealt with under their own name. R.J.T.

Leptospermum, a genus of the family Myrtaceae, consisting of shrubs or small trees with alternate leaves. It occurs in Australia and Malaysia, with two species in New Zealand: most of the Australian species are endemic. The calyx-tube is bell-shaped, with 5 herbaceous or membranous lobes; petals 5, orbicular; stamens numerous, in a single row; capsules opening at the top by valves; seeds (in some species) with transparent wings along their angles. The genus is difficult to classify, owing to the paucity of distinguishing characters. *L. laevigatum* is one of our best sand-binders, forming dense shrubberies on the coastal dunes. *L. scoparium* has pink or white flowers, resembling apple-blossom; those of *L. flavescens* are greenish-white. The leaves of the former of these species (called 'manuka' or 'scrub manuka' in New Zealand) were used by Cook's sailors at Dusky Bay, in conjunction with those of the spruce, to brew a kind of beer—and by themselves as a substitute for tea: those of the latter have been more commonly used for that purpose since

Cook's time (see TEA-TREE). Its essential oil has been found to contain 8 per cent of phenol. All the species produce much honey, and are haunted by a great variety of insects and birds. The wood of several species is used by natives to make kangaroo spears and spear-handles.

Leucopogon, a large genus of the family Epacridaceae, consisting of shrubs (rarely small trees); most of the species are endemic in Australia, but a few are found in New Zealand, Malaysia, and the Pacific islands. Of the 133 Australian species most occur in Western Australia. The flowers are white, densely bearded within and borne in short highly ornamental spikes or clusters; hence *Leucopogon* species are sometimes called 'white-beard.' *L. biflorus,* found on the coast and coastal ranges of New South Wales, is locally known as 'old man's beard.' *L. Richei* (Carrotwood) has small white succulent berries, upon which the French botanist Riche sustained life when lost in the bush on the coast of South Australia. The timber of full-grown specimens is of a deep orange colour, inclining to red; being hard, close-grained, and exceedingly heavy, it is used for the knees of boats. The tortuous, rough-barked branches are adapted for rustic work. *L. lanceolatus,* a tall shrub, and *L. amplexicaulis,* with heart-shaped leaves clasping the stem, have small bright red fruits. The wood of the former, as also of *L. melaleucoides,* is hard and beautifully marked.

Lewin, JOHN WILLIAM (1770-1819), is first heard of as a 'painter and drawer in natural history' who in 1798 persuaded the Duke of Portland, then colonial secretary, to give him a passage to Sydney. He arrived in January 1800, in H.M.S. *Minerva.* In 1801 Governor King attached him to the exploring party under Lieutenant James Grant (q.v.) in the *Lady Nelson,* which after an unsuccessful attempt to survey Bass Strait proceeded to the Hunter River and explored it as far as Mount Tangerin, about 9 miles east of Singleton. In November of the same year he went in the *Norfolk* to Tahiti, was shipwrecked there, and returned in the *Porpoise* at the end of 1802. He then settled at Parramatta, where he is noted as sergeant in the local volunteer force; his name figures among those of Hawkesbury settlers who signed a loyal address to Governor Bligh after the rebellion; and in 1810 Macquarie appointed him coroner at Sydney. But his main work was delineation of the natural history of the new country. In 1805 he published *A Natural History of the Lepidopterous Insects of New South Wales,* the plates for which were drawn and engraved in the colony by him; in 1808 he followed this up with *The Birds of New South Wales,* with plates also engraved and coloured by himself in the colony, though the letterpress was set up and the book was first published in London—where the title was altered to *Birds of New Holland.* (This book was reissued in Sydney in 1813 under Lewin's original title.) In 1808, also, he advertised himself as a portrait and miniature painter, and four years later he opened an 'Academy for Painting' in Sydney. Macquarie had a high opinion of his artistic powers; he presented Lord Castlereagh with one of his paintings of Sydney, took him on the famous journey across the new Blue Mountains road, attached him to Oxley's expedition of 1817, and wanted to send him with P. P. King in the *Mermaid.* When Lewin refused this last work as involving too long a separation from his family, Macquarie proposed to the British government that he should be permanently employed as government artist. Lewin died on 27 August 1819, and his widow was granted a pension of £50 a year. Some of his paintings are in the Mitchell Library at Sydney. Two were reproduced to illustrate Oxley's published journal of the 1817 tour. An enlarged edition of the *Birds of New South Wales* was issued in London in 1822; another, with many alterations and additions by later naturalists, in 1838. It is worth noting that his first book, the *Lepidopterous Insects,* was avowedly published 'to furnish the Author with the means of returning to England,' while in 1808 his wife had to run an inn and a shop: before Macquarie's time art was evidently no means of livelihood in New South Wales. See ART.

Lewis, SIR NEIL ELLIOT, born at Hobart on 27 October 1858, and educated at the local high school and at Balliol College, Oxford (B.A., 1882; M.A. and B.C.L., 1885), was called to the bar in London in 1883 and to the Tasmanian bar in 1885. Richmond sent him to the legislative assembly in 1886, and he retained the seat until federation. In 1892-4 he was attorney-general in the Dobson ministry, leader of the opposition in 1894-7, and premier in 1899; the interval he spent as a Tasmanian representative on the federal convention of 1897-8. For the first four months of 1901 he was a member of the first federal ministry (Barton's), without resigning his position in the State ministry; he then gave up the federal position, and remained premier till April 1903. He returned to office in 1909, and (except for about a week in that year) held it till 1912. From 1890 to 1912 he was on the council of the university of Tasmania (vice-chancellor 1903-9). He retired from politics in 1920. (C.M.G., 1901; K.C.M.G., 1902.)

Libraries, Public. *Victoria.*—The first free public library in Australia was that founded in Melbourne in 1853, the existence of which was made possible mainly by the zealous efforts of Redmond Barry (q.v.) and the active sympathy of Governor Latrobe. As early as 1842 Barry had set aside for a free circulating library one of the rooms in his cottage in Bourke-street-west; this contained a fair collection of standard works, which he had taken with him to the colony, and as many of the current English magazines as reached him and his friends. A few books and magazines could also be obtained from the mechanics' institute which was established in 1840. A sum of £13,000 for the erection of a library building and the purchase of books was voted by parliament in January 1853, and in the following July the first board of trustees was appointed, with Barry as chairman. The library was opened with 3846 volumes, for reference only, in February 1856; it was free to all persons over the age of 14 years. A. H. Tulk was the first librarian. In 1858 the establishment of an art gallery and museum in association with the library was considered, and in May 1861 a museum of art was opened in the library building. In 1865 the trustees concurred in the proposal of a commission of fine arts (appointed in 1863) that the public library, the galleries and schools of art, the museum of natural history and allied economic branches relating to science, art, and manufactures should be united to form one institution; they also approved of the suggestion that all the

buildings required for the combined institution should be on the site of the public library. On 29 December 1869 an act was passed to provide for the incorporation and government of the public library, museum and national gallery of Victoria. Until 1882 there was no subject catalogue of the books in the library, nor were there any special lists or indexes for the guidance of readers (except some rough 'bay catalogues'); but in that year a complete reorganization of the library was begun, though some years passed before the work was completed.

In April 1859 it was decided to introduce the system of circulating cases of books amongst municipal libraries and literary institutes, so as to afford a frequently changing supplement to the local collections. At first the experiment, which was put into operation in 1860, was confined to institutions within ten miles of Melbourne; in 1867 this limit was abolished, and cases were sent to country libraries. During 1922 3621 volumes were lent in this way throughout the State. The trustees frequently considered the advisability of establishing a lending branch, but were hampered by lack of funds and accommodation until 8 August 1892, when the lending branch was opened in temporary quarters in the newspaper room. In 1913 the library was moved from the galleries which it had long since overcrowded, and was housed in a new domed building, the central part of which is a magnificent circular reading-room. The library now contains in the reference department 298,000 volumes, besides a very large collection of newspapers; in the travelling libraries section 11,000 volumes; and 41,000 volumes in the lending branch.

New South Wales.—The origins of the free public library of New South Wales date farther back than those of the Victorian library, though its establishment as a public institution was later. In 1821, to lessen the inconvenience occasioned by the lack of books in the colony, a few leading citizens of Sydney devised an ingenious scheme whereby a consolidated catalogue was made of the books in their private libraries; this facilitated the borrowing of books from one another. But the scheme was necessarily limited in scope, and unable to meet the increasing demand for new books; on 3 February 1826, therefore, the Australian Subscription Library and Reading Room was established, the conditions of membership being drawn up with a view to keeping the library 'select.' The entrance fee was five guineas, the annual subscription two guineas; admission was by ballot, one black ball in four disqualifying the applicant. The original printed list of rules, officers and members is preserved in the Mitchell Library at Sydney. On 1 December 1827 the library, consisting of about 1000 volumes (some of which had been obtained direct from England and others locally by gift or loan) was opened on the first floor of No. 1 Terry's Buildings, Pitt-street. The first librarian was Peter Cooke, and he also acted as dispenser of the Sydney dispensary (see HOSPITALS), which occupied the ground floor of the same building. Governor Darling strongly favoured the movement, and his aide-de-camp Lieutenant de la Condamine was the first secretary of the institution. In the first order for books sent to London the great quarterlies had precedence; then came standard works on history, theology, biography, science, and travels; Scott's novels were the only books of fiction. In a couple of years, however, the committee had to yield to the weaker tastes of many subscribers and order the works of 'Bulwer, Dickens, and Lever' and 'any other recent novels which have been reviewed and approved by the writers of the *Edinburgh* or *Quarterly Reviews.*' In 1830 the committee, claiming to have laid the foundations of a public library, asked Darling for a grant of a town allotment, and suggested that the museum (then in an embryo state) should be combined with the library. Darling was sympathetic, and authorized the committee to select two allotments of ground in Hyde Park as a site for the library, on the understanding that suitable provision should be made to house the museum in the proposed new building; he also authorized the selection of two allotments at Rushcutters' Bay, from the sale of which the committee might obtain the funds necessary to carry on their work. The grants were selected, but not confirmed during Darling's term of office. In 1834 Governor Bourke confirmed the grants at Rushcutters' Bay, but substituted others for the Hyde Park allotments, a change which the committee refused to accept; finally they accepted a grant of the site at the corner of Bent-street and Macquarie-street on which the public library now stands. Before the land was conveyed to the society, Bourke formed the opinion that it would be unwise to house the museum in a building belonging to a private society, and suggested that the grant should be cancelled and the government should erect a building with library accommodation; if at a subsequent date the society were required to vacate the premises, it should receive a building allotment or its equivalent in money. In 1838 £4000 was voted to erect a public library and museum; but before commencing operations the government required some assurance that the public should have free access to the books, whereas the committee maintained that, if the institution was to be transformed into a public library, the government should purchase the books, fittings, etc. on which about £3000 had been spent. On 25 October 1838 the committee agreed to set aside a special room for the use of non-subscribers, who would be allowed access to the books for reference; they were of the opinion that the expense of an extra librarian should be met by the government. As the governor would not agree to this proposal the land-grant reverted to the committee in May 1841, and a new building was completed in November 1845. For many years the library had been unsuitably housed. In 1831 the books were removed from the Pitt-street building to rooms provided by the government at the old post-office in George-street, and thence (*a*) to a house in Bridge-street not long vacated by the chief justice, (*b*) to a small annexe to St. James's parsonage in Macquarie-street and (*c*) to rented rooms in Macquarie-place. The only important change made in organization during this period was the incorporation of the library in 1834, and the appointment of trustees; in the same year a first attempt was made to classify the books. The library was seriously hampered by financial difficulties, to meet which Dr. Lang in 1844 proposed that the system of balloting for members should be abolished, and the subscription fee reduced to £1 per annum. This suggestion, though defeated at the time, was partially adopted in 1852, when admission by ballot was discontinued, the nomination of three proprietors being accepted in its place. To widen the basis of admission still further, an act of council was passed whereby the library was formed into a proprietary corporation of 1000 shares of £25 each, the annual subscription being £1 a share.

Shareholders were entitled to a separate frank or token for each share held; these were transferable, and on presentation admitted the bearer to the reading-room—the object being to afford access to the public for reference purposes and to encourage the impression that the institution was in a way a public library. Indeed in 1857 the government recognized the importance of the library by placing in it the English patent law commissioners' publications, about 200 volumes in all. But these expedients did not place the institution on a satisfactory footing, and towards the end of 1859 the trustees urged the government to buy the whole property for £15,000. William Forster, then premier, favoured the proposal, but his ministry went out of office before any decisive action was taken. In April 1862 negotiations were entered into with the works department to convert the premises into government offices. The committee hoped to sell the books and fittings, as well as the building and land, to the government, for it was known that the legislative assembly favoured the establishment of a public library, £25,000 having been voted for that purpose in the previous January. When, however, this proposal was placed before parliament, it was defeated, the library being condemned for its exclusiveness. The shareholders thereupon agreed to a suggestion of P. J. Elliott, then librarian, that he should rent the library from them for £300 a year, and he opened it as a private enterprise under these conditions on 1 January 1864. The experiment was a failure. In April 1866 a private act authorized the reconstruction of the company, shares being written down from 1000 of £25 each to 2000 of £5; this also failed to put matters straight, and the entire property was offered to the government for £8000. On 12 March 1869 the legislative assembly agreed to the purchase, but the decision was not acted upon until September, when the government paid £1500 for the books and £3600 for the building—a sum barely sufficient to cover the trustees' financial obligations. A probably determining influence in favour of the purchase was the fact that the executors of the will of Judge Wise had handed over to the government his library of books, pamphlets, and papers, to be placed in the 'free public library' as soon as one was established; this library of about 6000 volumes included a number of Australian books and newspapers, a section in which the subscription library was very weak. The new free public library was opened on 30 September 1869 as a reference library; it contained about 20,000 volumes, but a number of these were removed from the shelves as being a lure to idle and frivolous persons. In 1885-6 a wing facing Bent-street was added, and in 1889 the rest of the building was remodelled uniformly with the new wing. On 30 June 1924 the reference library contained 216,810 volumes.

The establishment of a lending branch of the library was discussed as early as 1874, but was generally considered impracticable until the library was more suitably housed. Nevertheless a lending branch was established in 1877, but had to be removed to a separate building in 1881; in 1908, under the Sydney corporation amendment act, it was vested, with all its books, papers, and fittings, in the city council of Sydney, which entered into possession in October 1909. This lending library, the only important municipal library in Australia, extended its functions in 1915 to include a children's section. During 1923 the library issued 446,646 books to 22,516 borrowers.

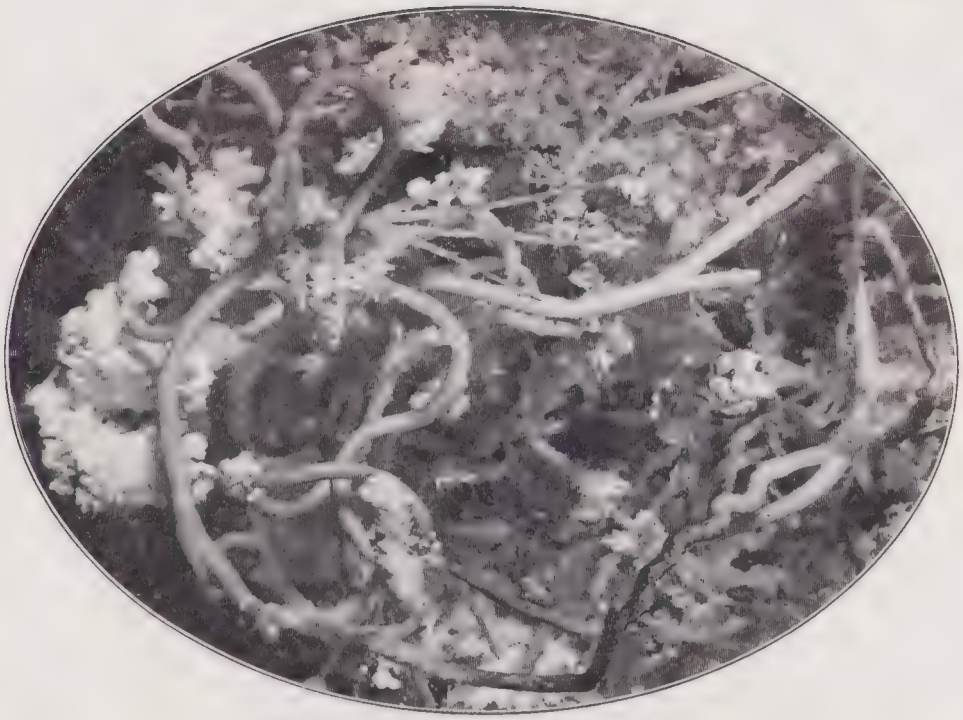
In 1883 a country circulating department was established as a branch of the public library, and boxes of books were sent to literary institutes in the country districts. This department is now divided into the country circulating section and the country reference section. The circulating section was extended in 1919 to include boxes of children's books for small country schools, 50 boxes (each containing about 35 books) being equipped and sent out by the end of 1920. In June 1924 28,973 books were circulating in this way. The country reference section was established in 1913, with the idea of supplying directly to individual borrowers 'definite information on a definite subject;' in June 1924 it contained 10,172 volumes.

Of the gifts and bequests made to the library the most valuable single gift is a first folio edition of Shakespeare, presented in 1885 by Richard and George Tangye of Birmingham. On 17 October 1898 David Scott Mitchell (q.v.) communicated to the trustees his intention of bequeathing to the library his large collection of Australian books, pictures, maps, engravings, and manuscripts—many of which are invaluable—on the sole condition that the government should take early steps to erect a suitable building, with provision therein for keeping his collection by itself and making it freely accessible to students of Australian history under regulations similar to those obtaining at the British Museum. Nothing was done by the government until 1905, when the condition was accepted; the Mitchell wing, begun in 1906, was officially opened in March 1910. For fuller details of the Mitchell Library see the biography of its founder.

To emphasize the value of the public library to the business community, a special exhibition of technical and commercial literature was held in Sydney by the trustees in July-August 1919; as a result of the increased interest aroused, a special research department was created, and a staff appointed to collect material needed for special inquiries, especially of an industrial character.

In May 1919 William Dixson offered to the trustees of the library a number of important historical pictures—including Sir Joshua Reynold's portrait of Captain Cook and Gilbert Stuart's of Lord Sydney—on condition that a gallery to accommodate them was added to the Mitchell Library building. In April 1924, no advantage having been taken of the offer meanwhile, he repeated it, adding that at his death the whole of his Australian manuscripts, books, and pictures would be handed over to the library on conditions similar to those applying to the Mitchell collection. On 17 December 1924 the offer was accepted, provision being made by act of parliament for the eventual erection of a national library adjoining the Mitchell building and the immediate addition to that building of a wing for the reception of Dixson's pictures—to be known as the William Dixson gallery.

In 1851 a committee was appointed by the senate of the university of Sydney to form a library about the small nucleus of volumes purchased from the collection of Dr. Mackaen. By purchase and bequest the library had grown to a considerable size by 1885, when Thomas Fisher of Sydney bequeathed £30,000 'to be applied and expended by the senate in establishing and maintaining a library for the use of the University.' As a building to house the existing collection was urgently required, the senate decided to divide the bequest into two parts, £10,000 to



'MYSTERY,' JENOLAN CAVES, N.S.W.

BASIN, WOMBEYAN CAVES, N.S.W.

LOT'S WIFE AND THE COCKATOO,
Wombeyan Caves, N.S.W.

be reserved as a perpetual endowment fund for maintaining and adding to the library, and £20,000 to be set aside for the erection of a building to be designated the Fisher library. As the building fund was insufficient to provide the necessary accommodation, the government was asked to subscribe a similar sum, but the proposal was not seriously considered until 1900, when it was referred to a parliamentary standing committee of public works. As a result of the committee's report, the government decided to meet the whole cost of the proposed library buildings, leaving the Fisher fund and its accumulations to be a perpetual endowment for library purposes. The new building was opened at the end of 1909. A munificent bequest of books and manuscripts has recently been received from the library of Sir Charles Nicholson (q.v.).

South Australia.—The South Australian Institute, whose library was available for circulation only to subscribers but could be freely used by the public as a reference library and reading-room, was established by act 16 of 1855-6. The institute itself resulted from an amalgamation of a mechanics' institute (founded soon after the establishment of the colony) with a subscription library. In 1859 the institute developed a system of travelling libraries, and claims to have been the first library in the world to circulate books in this way. By an act of 1884 the institute was merged in 'The Public Library, Museum and Art Gallery of South Australia,' controlled by a board of 14, five of whom were appointed by the governor and nine elected by various educational societies. The board now has under its control five departments—administration, public library, museums, art gallery, and archives. The archives department was established for the collection of original documents likely to be of service in compiling a history of the State. To assist in the development of this department Professor G. C. Henderson of Adelaide was in 1914 commissioned by the South Australian government to report on the system of keeping archives in England, France, Belgium, Holland, and Ceylon; he also obtained valuable information from the United States and Canada. A suitable building for housing the documents and staff was provided in 1921. In 1922 the archives contained 171,227 documents, 4298 photographs and 97 maps.

The public library has no circulating or lending department, but the government subsidizes the Adelaide Circulating Library, a subscription library established under the act of 1884. A children's section was opened in 1915, and lectures are arranged. On 30 June 1923 there were 122,647 volumes in the library, 118,010 of which were in the main library, 2550 in the duplicate Australian collection and 2087 in the children's section.

Tasmania.—The public library of Tasmania, though small, has had an interesting history. In 1849 a subscription library was founded under the patronage of Sir William Denison, who placed a sum of £100 on the estimates for the purchase of books. On 25 August 1850 the books and property were vested in trustees 'for the use of the public;' but it was not until 1859, after parliament had voted a subsidy of £ for £ subscribed (in addition to £200 already granted) that the public was allowed free access to the library. Unfortunately, as soon as the library became free the number of subscribers fell off and the additional subsidy was withdrawn; the trustees were thereupon obliged to limit the privileges of the institution to subscribers and honorary members, and in June 1867 had to close it down. It was reopened in 1870 under the joint control of parliament and the municipal council, which had made suitable provision for housing it in the new town-hall building. An act passed during the year provided for the incorporation and government of the Tasmanian Public Library; control was vested in eight trustees, four elected by the governor-in-council and four by the municipal council. In 1902 the trustees decided to take advantage of the offer made by Andrew Carnegie to pay for the buildings and fittings if the corporation would grant an adequate site for a free public library and provide the necessary funds for its maintenance. In 1903 Carnegie undertook to pay £7500, under certain conditions as to site and maintenance, stipulating also that a department should be established for lending books free of charge. A lending branch was opened on 4 July 1907, the additional cost being met by increased grants from parliament and the city council. In 1922 a country circulation branch was opened and a children's library established. In 1923 the library, with an income of £1600, contained 25,000 volumes; the number of issues from the lending branch amounted to 32,000.

Western Australia.—There was no public library in Western Australia before 1889, though the government gave small subsidies to the Perth mechanics' institute (founded in 1851) and the Fremantle literary institute. To commemorate Queen Victoria's jubilee in 1887, the government founded the 'Public Library, Museum and Art Gallery of Western Australia;' the library was the first section opened, in January 1889. It is a public reference library only, but cases of books from a second collection are sent out on loan to country institutions; 201 institutions were served in this way during 1922-3. Since 1914 only small annual additions have been made to the library stock, which in June 1923 comprised 132,767 volumes in the reference section and 15,910 in the circulating section.

Queensland.—The Brisbane Public Library was formed in 1886, its nucleus being a small private library purchased by the government in 1895; the management was vested in a board of trustees. The name was changed to 'The Public Library of Queensland' in 1898, though the institution was not officially opened to the public until 1902. In 1906 the board of trustees was dissolved, and from that time onwards the library has been administered directly by the government as a branch of the public service. It is a reference library only. In 1923 it contained 32,700 volumes.

The Commonwealth National Library.—The library committee appointed by the first federal parliament in 1901 recognized the necessity of making collections for a library which would be useful to members when the federal capital was established. In 1902 the acquisition of books for a Commonwealth parliamentary library was therefore begun, special efforts being made to secure books, records, and maps of Australasian interest. In 1908 negotiations were opened with E. A. Petherick for the acquisition of his Australasian collection, comprising about 10,000 volumes; it was taken over in 1909, the agreement being ratified by parliament in 1911, and Petherick remained in charge of the books until his death in 1917. The committee then decided to subdivide the library into a parliamentary section and an Australasian section, the latter to be developed into a national library for Australia. In 1923, when the Commonwealth government purchased for the library Captain Cook's manu-

script journal of his voyage in the *Endeavour* and four other very valuable Cook documents, the Australasian section was definitely entitled 'The Commonwealth National Library.' In the plans for the federal capital provision has been made to accommodate the parliamentary section in the parliament house, and the national library in a separate building adjacent to it; both sections will, however, remain under one control.

In 1912 the library committee undertook the publication of the *Historical Records of Australia*, of which 30 volumes have now been issued; the committee also publishes a *Commonwealth Parliamentary Handbook*. A classified and author catalogue of the library, exclusive of the Petherick collection, was issued in 1912.

By a provision of the Commonwealth copyright act of 1912 the publisher of any book, pamphlet, etc., printed in Australia is required to supply a copy to the library.

At the end of 1924 the two sections contained between them 67,000 books, 6000 pamphlets, and 2000 bound volumes of newspapers; the library also possesses a fine collection of early Australian documents, maps, pictures, and engravings.

Lice. See BITING-LICE, SUCKING-LICE, and HEMIPTERA.

Lichens, the popular name for vegetable growths composed of certain algae and of fungi supposed by some authorities to be parasitic on them. They are certainly of composite structure; the vegetative thallus is formed of hyphae embracing certain green or blue-green algal cells, whereas the reproductive organs are identical with those of various families of true fungi. The algal cells (gonidia), by means of their chlorophyll contents, form organic carbon compounds by which the fungal cells benefit, but here the true parasitism ends. With the exception of one or two species of *Endocarpon* (an aquatic form) they are regarded as air plants, and take large amounts of CO_2 from the air, deriving no food-supply from the rhizoids by which they cling to rocks, tree stems, old wood-work, etc. They thus differ from fungi, which obtain their nourishment from either living or decomposing animals and plants. Moreover the gonidia are capable of separating from the thallus, and of growing by themselves like free green algae. They have the widest distribution of any plants, being found from the seashore to the highest mountain top and from the equator to the poles. Their utility in nature is due to their peculiar power of burrowing into the hardest of rocks—even flint, glass, or granite—and making for themselves homes in the form of foveoli, thus preparing the way for the reception of larger forms of plant-life. This power is furnished chiefly by the carbonic acid absorbed from the air. Bachmann's observations show that under the attacks of lichen tissue granite is somewhat rapidly decomposed into a clay-like substance; quartz elements, however, are strongly resistant. Limestone, when attacked by the hyphae of *Chroölepus* algae, is perforated and becomes sponge-like.

For purposes of classification the systematic place of the various species depends largely on the relation of the lichen-forming fungus to the lichen algae. The reproductive organs (apothecia) found on the surface of the thallus form the basis of classification, and require microscopic study. They are of several colours and of widely different forms (e.g. semi-globular in *Calicium*, peltate in *Usnea*, plate-like in *Parmelia* and *Sticta*). According to Bruce Fink, lichen spores germinate and attack the free algae as other fungi attack their hosts. Northern New South Wales, Queensland, and Fiji are alike characterized by the number and similarity of their epiphyllous lichens. Many species contain gonidia resembling those of *Chroölepus* algae, especially those found on branches in mangrove swamps. The alga *Chroölepus umbrinus* is found in no less than 13 genera of lichens—or at any rate the algal symbiont of those lichens, if not of that species, resembles it most remarkably. The great majority of our lichens are associated with *Protococcus* or closely allied genera, the algae (usually bright green) that are seen on damp stones, fences and trees. The blue-green algae (Myxophysceae) are distinguished by their colour and gelatinous cell-sheath; the hyphae as a rule permeate the sheath, leaving the cell intact. This type of contact prevails in *G. glaeocapsa* and allied algal forms. See ALGAE.

Light, WILLIAM (1786-1839), was the eldest son of Francis Light, master of an East Indiaman, who married a daughter of the native chief of Kedah in the Malay Peninsula and received as her dowry the island of Penang; this he handed over to the East India Company, renaming it 'Prince of Wales Island' and stipulating for an annual subsidy to his father-in-law. William Light was sent by his father to England in 1792 and placed under the care of George Doughty of Theberton Hall in Suffolk: in 1800 he joined the navy as midshipman aboard the *Clyde* frigate, saw service in eastern waters, and was for a short time prisoner of war in France. In 1808 he left the navy to join the army (cornet of dragoons, 1808; lieutenant, 1809; captain of infantry, 1814; brevet-major, 1817), and served through the Peninsular war at first in the 4th dragoons, afterwards as an intelligence officer on the staff of the Duke of Wellington; Napier relates several anecdotes of his remarkable courage and resource. Leaving the army on 3 May 1821, he travelled in Italy and Sicily, and in 1823 joined as colonel the Spanish 'constitutional' army, which was defeated by French intervention in Spanish affairs under the aegis of the Holy Alliance. Light's next travels, in Turkey and Egypt, resulted in his joining the Egyptian navy at some time in the early thirties: there he met Hindmarsh (q.v.), and, when the latter was chosen to be governor of South Australia, was appointed surveyor-general to that colony. Sir Charles Napier, to whom the governship had been previously offered, strongly recommended Light for the post, but Hindmarsh had already obtained the appointment.

Sailing in the brig *Rapid* (which he navigated himself), Light landed on Kangaroo Island on 21 August 1836, and at once set about finding a site for the capital of the new colony. By the end of the year he had decided on the location which Adelaide now occupies, and successfully maintained his decision against Hindmarsh's preference for Port Lincoln and Jeffcott's for Encounter Bay. During 1837, however, he quarrelled with the London commissioners (who thought him too leisurely in his work), and on 2 July 1838 resigned his post to become the head of a private firm which undertook the survey of Port Adelaide. In memory of his childhood he named his house 'Theberton Cottage;' but an unfortunate misprint in the preface to his published journal has perpetuated

the spelling 'Thebarton.' On 22 January 1839, while he was preparing this journal for publication, a mass of personal documents dealing with his whole European career was accidentally destroyed by a fire which destroyed his house. The shock gravely impaired his already undermined health, and he died on 5 October 1839. He was buried in Light Square in Adelaide, and in 1843 a Gothic cross—designed by G. S. Kingston (q.v.)—was erected over the grave: this monument, having been much damaged by the climate, was replaced in 1905 with a granite pillar. Light is also commemorated by a statue in Victoria Square and a portrait in the Adelaide art gallery.

Light has been described as 'the Admirable Crichton of the early 19th century,' and Napier in his *Peninsular War* mentions 'the variety of his attainments—artist, musician, mechanist, seaman and soldier.' The portrait just mentioned is of Light's own painting, three of his water-colours are in the same gallery, and he published in England *Sicilian Scenery* (1823) and *Views of Pompeii* (1828), with engravings made from his own sketches. His *Brief Journal*, published in Adelaide in 1839, covers only a year or so of his voyage to and life in South Australia, later records having perished in the fire already mentioned.

See Thomas Gill's *Colonel William Light, the Founder of Adelaide* (Adelaide, 1911).

Lighthouses on the Australian coast may be divided into two classes, those that protect inter-State and coastal traffic, and those that merely indicate the entrance to a port. The lighthouses of a permanent character have been for the most part constructed in massive concrete or masonry, and contain lights varying from 500,000 to 1500 candle-power. Their distance apart depends largely on the amount of shipping affected. On the coast of New South Wales the average distance is 32½ miles, and in many instances one light is not lost until the next becomes visible; on the Victorian coast the average distance is 62 miles. On the Queensland coast the average distance is 107 miles; but this includes the long unlit stretches of the Gulf of Carpentaria—on the east coast the distance is only about 64 miles. In South Australia the average distance is 90 miles; in Western Australia and the Northern Territory the distances average 218 miles and 1040 miles respectively. The Tasmanian coast is fairly well lighted, the average distance being 60 miles. The positions of most important Australian lighthouses are noted in GEOGRAPHY, ECONOMIC, q.v.

During the past 20 years the character of the lights exhibited has been frequently altered from fixed to flashing, and from slow flashes to quick flashes. The tendency, however, is to adopt the innovation in all positions, regardless of circumstances; the difficulty of obtaining bearings to a quick-flashing light seems to be lost sight of. In many cases a fixed or slow-flashing light is much more desirable—especially in long channels, where a number of lights can be seen at once, and it is frequently difficult to ascertain the vessel's position in the channel.

The inferior translucency of coloured glass considerably curtails the visible distance of coloured lights: in some instances, therefore, coloured celluloid films have been substituted for coloured glass, with good effects. But in important positions coloured lights should not be used at all.

The use of acetone for unattended lights has much increased their reliability. With occulting gear, and by using the sunlight as an extinguishing agent, these lights now run for as long as 12 months with one charge of acetone. Some trouble was at first experienced with seabirds, but this has been largely removed by the use of fine wire screens to prevent birds from landing on the lanterns. Lights of this character are largely used on the Australian coast, more especially in Spencer and St. Vincent gulfs, to indicate shoals and changes of direction for channels. Acetone, however, is cheap only for quick-flashing lights with a correspondingly long dark gas-saving period.

Historical.—The first lighthouse erected in Australia was that placed by Macquarie on the outer South Head of Port Jackson, close to the present lighthouse. He laid the foundation-stone on 4 June 1816, but did not report the completion of the 'Very Elegant and Strong Stone Tower and Light House' until 16 May 1818; Bathurst promptly rebuked him for spending so much money on it. Greenway the architect, who supervised the construction, was rewarded with a conditional pardon. According to Oxley's report, 'Macquarie Tower and Light' stood 76 feet high on a spot 277 feet above the sea, and the light could be seen from a vessel's deck on a clear night 24 miles away. The expense of maintaining it was met by a charge of 2d. per ton on all vessels entering Port Jackson except such as were registered in New South Wales; and one of the earliest results of its completion was the making of the Old South Head road 'from Sydney to Macquarie tower, South Headland, 7 Miles with 11 Bridges.' In 1846 the administrator of the Port Phillip settlement bestirred himself for the safety of vessels moving along the coast in his charge, and sites for lighthouses were chosen on Gabo Island and Cape Otway; and in 1857 the South Australian government erected its first important lights on Capes Borda and Northumberland.

T.E.B.

Lignite. See MINERALOGY.

Liliaceae, a family of plants widely distributed in warm and temperate regions, with 45 genera and 189 species recorded in Australia. The genus *Asparagus* is represented by an indigenous species, *A. racemosus*, the roots of which are used medicinally in India. *Eustrephus* has also a single species, *E. latifolius*, endemic in Australia; it is a leafy climber with small fringed flowers and orange-coloured berries, which produces small edible tubers. *Rhipogonum* has one species (*R. scandens*, the Supplejack) in New Zealand; the rest are endemic in Australia. They are tall climbers, usually armed with prickles that enable them to climb large trees; the prickly species are popularly known as lawyer vines. The single species of *Dracaena*, *D. angustifolium*, is indigenous; that of *Geitonoplesium*, *G. latifolium*, is endemic. The latter has a glossy blue-black berry, and its young shoots are a fair substitute for asparagus. *Milligania* is a small genus of densely tufted woolly herbs, exclusively Tasmanian, with loose spikes of membranous flowers. *Allania* is an endemic genus of one species, *A. Endlicheri*. It is a small herb with matted intricate thread-like leaves and small clusters of white flowers, growing in fissures of the rocks in shady gullies, in a small area of the Blue Mountains. See ASTELIA, BULBINE, CHRISTMAS BELLS, DIANELLA,

GRASS-TREES, SMILAX, STYPANDRA, THYSANOTUS, XEROTES.

Lilley, SIR CHARLES (1830-1897), born at Newcastle-on-Tyne on 27 May 1830, educated at University College, London, and for some time articled to a London solicitor, migrated to Queensland in 1856 and, while still practising his profession, edited the *Moreton Bay Courier*. When Queensland in 1859 became a separate colony, Lilley was elected to the first assembly by Fortitude Valley (a suburb of Brisbane), and remained member for that constituency until he abandoned politics in 1874. In 1865 he took the attorney-generalship in the Herbert ministry and retained it under Macalister until August 1867, with the exception of three weeks in 1866 when R. G. W. Herbert (q.v.) resumed the premiership. On 25 November 1868 he himself formed a ministry, which lasted till 3 May 1870, and broke up because Lilley on his own responsibility ordered a government steamship to be built in Sydney against the wishes of his colleagues. When nearly four years later (in January 1874) his party came into power again, he refused to take office, and was made temporarily a judge of the supreme court; the appointment was confirmed in the following July, and in 1879 he became chief justice of the colony. In February 1893, having been accused by Sir T. McIlwraith of indiscretion in private references to cases on which he was adjudicating, he retired from the bench on a pension, and died on 20 August 1897.

Lilley was from the first much in advance of his time as a politician. Thirty years later he would have been a Labour leader; in the sixties he was regarded with suspicion as an extremist even by his own followers. On one subject, however, he was listened to with submission; his views on education, during both his parliamentary and his judicial career, had a dominating influence on the educational policy of the colony. He was instrumental in founding the Brisbane grammar school, and was for many years chairman of trustees of the school. In 1874 he was chairman of a royal commission on education whose report was embodied in the education act of 1875—that which established free, secular, and compulsory education in Queensland, and created the department of public instruction. In 1888 his name headed the signatures on a petition for the establishment of a local university; in 1891 he was chairman of a royal commission on this subject, and reiterated his persistent opinion that 'all our public education should be free ultimately.' Among other notable doings may be noted his initiative in creating a ministry for goldfields to help the mining industry, his active support of the Labour party by laying the foundation stone of the Brisbane trades hall while still chief justice (1891), and his extraordinarily active influence on legislation while out of office. It was, for instance, as a private member that he in 1870-1 forced through the bill substituting a simple for a two-thirds majority in the case of bills affecting popular representation in the assembly. He was also, as attorney-general, a member of the royal commission which in 1866-7 revised the statute law of the colony. (Kt. Bach., 1881.)

Lilly-pilly. See EUGENIA.

Limestone Caves. Limestone honeycombed by caves covers wide areas in all the Australian States. It generally outcrops in bold and picturesque cliffs or ranges of Palaeozoic age, although it is found also in beds which range from Recent to pre-Cambrian times. Owing to the intrusion of igneous rocks, the limestone in many places has been changed into white or coloured marbles of fine quality.

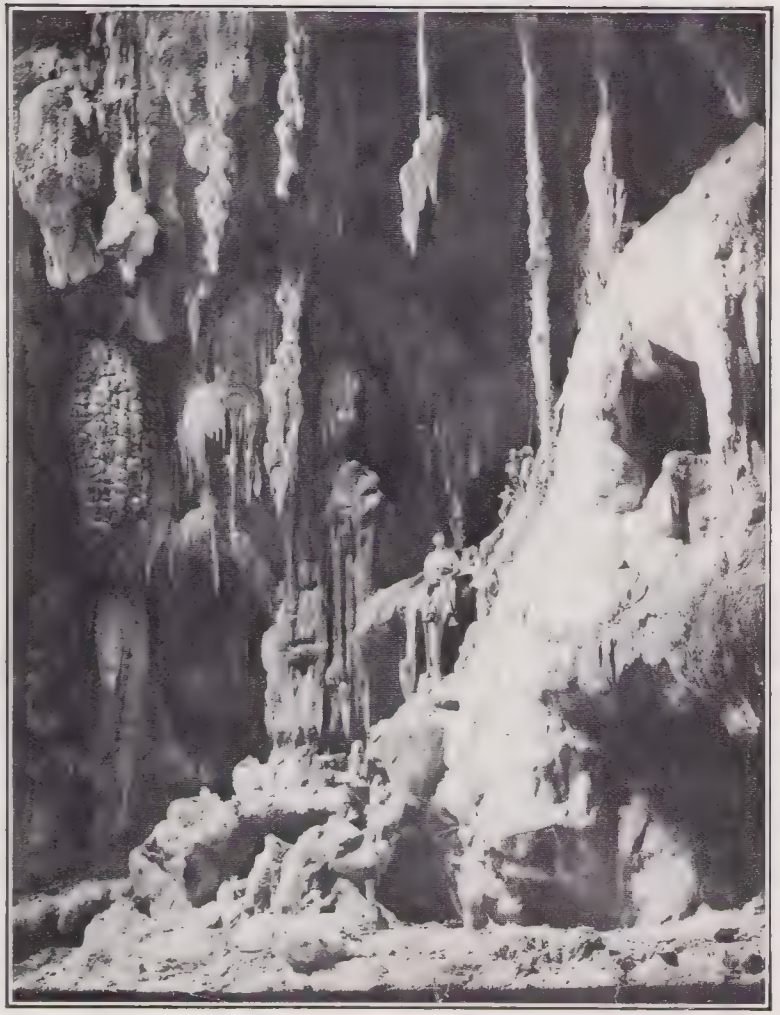
Australian caves are remarkable for their number, extent, and beauty. Stalactites, stalagmites, and columns, curtained and floored with sparkling dripstones, alternate with banded draperies like shawls. Some growths are translucent, others snowy white or tinted with colour. There are 'coral bowers,' 'fairy grottoes,' and white, cream, or amber-tinted 'cascades.'

A stalactite first appears as a slender, reed-like tube, and lengthens at the lower end until choked by lime; then deposition takes place on the outside, forming concentric rings that are distinctly marked when a little iron is present in the lime solution. Crystallization, fibrous and radiating, appears to take place coincidently with deposition, but in many cases is subsequently re-arranged and obliterated by the rhombohedrons of calcite. The presence of aragonite has not yet been determined, although this form of crystallization has been found in American caverns. Irregular or intermittent supplies of the lime-charged water, capillary attraction, and consequent changes in the rates and stages of crystallization, tend to decorate the stalactites with sprays and nodules like coral, and in other respects to alter their contour. The same causes are probably responsible for the groups of lime tendrils which simulate the twisted stems of a climbing plant, or the finest filigree work, and are known as 'helictites' or 'mysteries.'

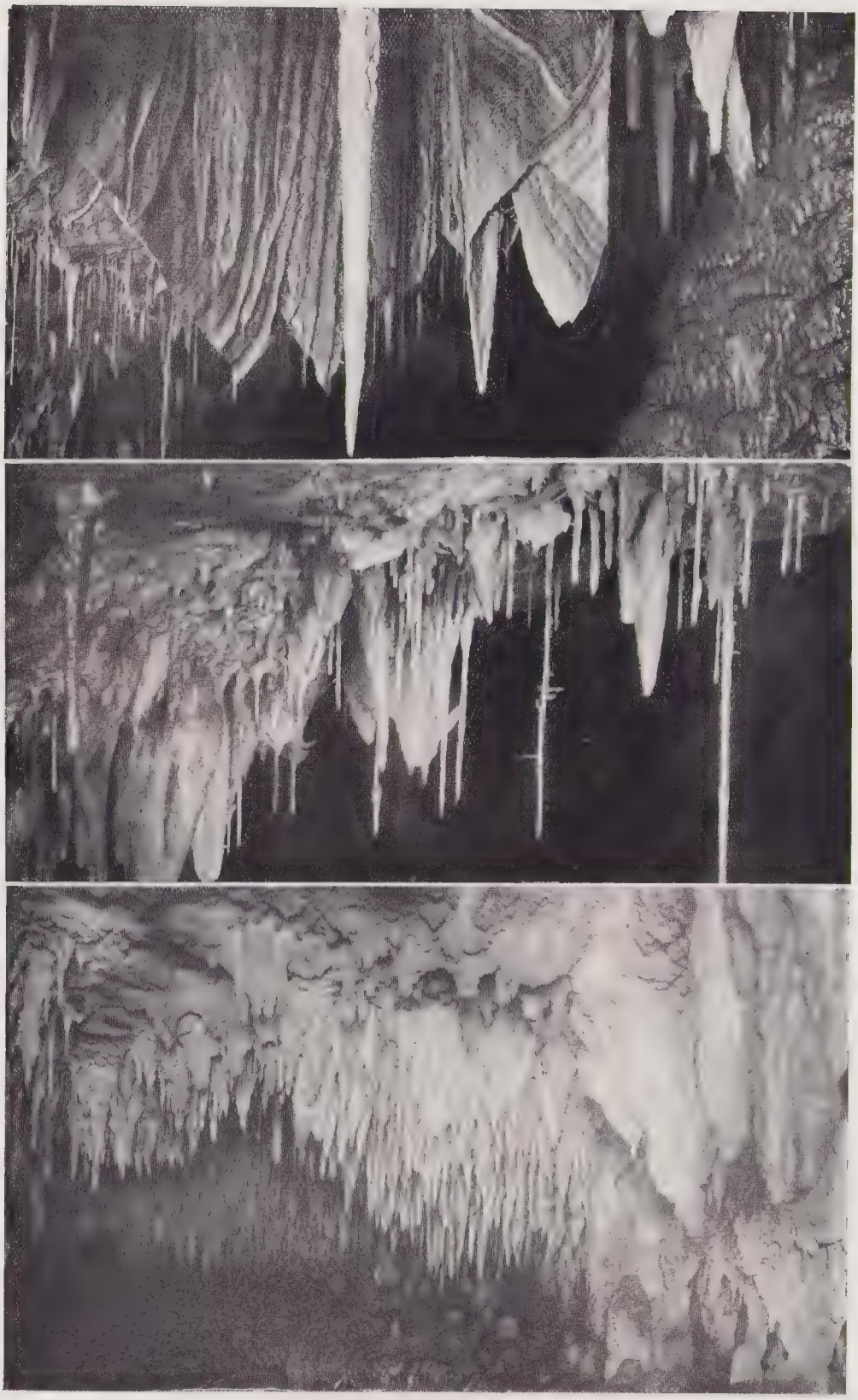
Stalagmites built up by the drip from overhanging stalactites are more regular in shape than those which obtain their supply of lime directly from the roof. Many roof-supplied stalagmites are of great beauty, being terraced by a series of inverted cones, which glisten with crystals on their upper edges but merge downwards into surfaces tinted with cream or amber. Basins and cavities that in the past have been periodically filled with water often exhibit myriads of clear (or tinted), semi-translucent, acute rhombohedral (occasionally scalenohedral) crystals, which form 'jewel caskets' and 'flower gardens.' In some of the shallow basins thin films of lime, which at first floated on the surface of the water, have broken and fallen in flakes that now imitate beds of down. Freakish mimicry of animate and inanimate objects is also of frequent occurrence. About the time taken in forming these curiosities we have no reliable data.

In *New South Wales* the caves near Wellington were described and mapped by T. L. Mitchell as far back as 1833. Four of the many other series discovered since then have been taken over by the government, which has made them easy to reach and comfortable to stay at. The chief series is at Jenolan (q.v.). The next in importance is at Yarrangobilly in the Muniong Range, 3200 feet above sea-level. It is reached by rail to Cooma (265 miles from Sydney) and a 65-mile drive thence by motor-car, or by rail to Tumut (318 miles) and a 47-mile drive. Caves open for inspection are the Glory Hole, the Jersey, the Harrie Wood, the Castle, and the Jillabenan. Like the Jenolan caves and those yet to be mentioned, they occur in Silurian limestones. At Wombeyan in the Main Range, almost due west of Mittagong, the limestone has been altered to a white marble; the caves

SHAWLS, BUCHAN CAVES, VIC.



CHILLAGOE. CAVES, Q.



1. FOLDED SHAWL, WALLINGUP CAVES, W.A.
2. NARRACOORTE CAVES, S.A.
3. MOLE CREEK CAVES, TAS.

are 1900 feet above sea-level, and are reached by train from Sydney to Mittagong or Bowral and a drive thence of about 42 miles. From Goulburn they are 50 miles by road. Caves open for inspection are the Creek (through which the Wombeyan Creek finds its way in flood-time), Fig-tree, Wollondilly, Kooringa, Guineacor, Junction, Forest Creek, Tinted, and Basin caves. The last-named is remarkable for a series of stalagmitic cavities shaped like swallows' nests, which vary in size down sloping walls until one of them (named 'The Royal Tub') is five feet deep and 3½ feet broad. Water passing over the sloping rock scoured out cavities; the liberated lime formed ridges on the outer rims of the cavities, and ultimately built up semi-circular walls decorated with crystals. The Wellington caves, five miles from Wellington on the western railway, are controlled by the local authorities, and are chiefly remarkable for their fossil remains, among which the following have been found:—*Diprotodon australis, Nototherium, Thylacoleo, Macropus,* and *Thylacinus* (Tasmanian wolf). At these caves mining for phosphates was at one time carried on. The Abercrombie caves, 26 miles south of Newbridge near Bathurst, consist mainly of a beautiful archway through which Grove Creek passes. Cathedral, Grove, and the Palace caves, and King Solomon's Temple, are also known, but are at present unimportant. They may be reached from Newbridge (26 miles) or Bathurst (43 miles).

In *Victoria* only the Buchan caves have been prepared for the reception of visitors. They are reached by rail from Melbourne to Sale (128 miles) or Bairnsdale (171 miles) thence by steamer through the Gippsland lakes and rivers, and finally by coach; they are 111 miles from Sale, 64 miles from Bairnsdale. They occur in an area of Devonian limestone that covers 70 square miles. The Fairy, Moon, Royal, Kitson, and Spring Creek caves are close to the township of Buchan; the Wilson lies to the east, the Murrindah and Lilypilly 2 miles north, and the Slocombe 11 miles north-east, near the Snowy River.

In *Queensland* limestone outcrops occur in many places, but its caves are for the most part unexplored. In the limestone belts between Brisbane and the Palmer River the best-known caverns are Olsen and Johannsen's, in Devonian limestone, 16 miles north of Rockhampton, and the Chillagoe, in Silurian limestone, about 140 miles west of Cairns. The latter include large chambers of considerable beauty. Caves of great size, one containing a remarkable subterranean lake, have been found 12 miles east of Camooweal, near the border of the Northern Territory.

In *South Australia* the numerous caves have received little attention, except those of Narracoorte, which occur in limestone of Miocene age seven miles south-east of the township and near the Victorian border. They include the Big, Victoria, Bat, Stick, West, Victoria, and Alexandra caves.

In *Western Australia* a gneissic granite range occupies an area in the south-western corner running 60 miles south from Cape Naturaliste. On the irregular seaward slopes of this range drift-sand and shells, including myriads of microscopic foraminifera, have been piled up in dunes to a height of 700 feet; the liberation of carbonate of lime from the shell-debris has cemented the loose particles into a calcareous sandstone, and wherever shells were most plentiful, masses of limestone have been formed, through which escaping waters tunnelled their way and formed caves. In this Recent limestone many fossil remains of vertebrates are found, both of existing and extinct species. In the Mammoth cave, 30 miles from Yallingup, the position is complicated by the intermingling of later fauna with an older series originally deposited elsewhere. Numerous bones and teeth have been identified as belonging to the common echidna (*Tachyglossus aculeatus*), extinct echidna (*Tachyglossus oweni*), giant echidna (*Zaglossus hacketti*), extinct Western Australian wombat (*Phascolomys hacketti*), and a kangaroo (*Stenthurus occidentalis*) quite distinct from the eastern Australian form. *Nototherium* is practically abundant, and several extinct kangaroos—*Macropus magister, M. anak, M. titan, Palorchestes crassus* and others not yet identified—also occur. There are 30 known caves, many of which have been made accessible for inspection. From Perth the nearest are in the electrically lighted Yallingup group, 20 miles from Busselton and 150 miles from Perth. Fifteen miles farther on is the Margaret River group; the Nindup group is about 30 miles from Yallingup. In the Lake cave of the Nindup group a thin sheet of lime ('the suspended table') 14 feet by 7 feet is held to the roof by glistening columns which emerge from countless delicate pendants, and is reflected in the clear waters of an extensive pool.

In *Tasmania* caves in Silurian limestone are frequent, both in the northern and in the southern districts, but only in the former have they been opened up. They include the Chudleigh caves, the Mole Creek series—Scott's, King Solomon's, Bayard's (Marakoopu), and Baldock's caves, all within easy distance of Mole Creek, 60 miles from Launceston—the Ulverstone caves at Gunn's Plains, 16 miles from Ulverstone, and the Winkleigh caves near Beaconsfield. In some caves (particularly in those at Ida Bay in the Huon district) myriads of glow-worms dot the cavern roofs with sparkling points of light.

Most of the Tasmanian caves are privately owned; those at Wellington in New South Wales are (as has been said above) under the management of the local municipal council; otherwise nearly all the caves in the various States are under government control. Where prepared for inspection, they may be viewed in comfort owing to the construction of well-graded pathways, cement, stone, and iron stairways together with protective wire-netting. Capable guides are employed, and accommodation houses are erected either at, or convenient to, the caves. O.T.

Limpets. See MOLLUSCA.

Lincolnshire, MARQUESS OF. Sir Charles Robert Wynn-Carrington, first marquess of Lincolnshire, third baron (from 1895 first earl) Carrington—born on 16 May 1843 and educated at Eton and Cambridge (B.A., 1863), entered the army and became captain in the Royal Horse Guards and lieutenant-colonel of the militia battalion of the Oxfordshire Light Infantry. From 1865 to 1868 he was member for Wycombe in the house of commons, but in the latter year succeeded his father as baron. Accompanying the then Prince of Wales (afterwards Edward VII) to India in 1875-6 as aide-de-camp, he established a personal friendship with the royal family; this, and his attachment to the liberal party in English politics—which was out of office in 1886-92 and 1895-1905—

account for his later career. From 1881 to 1885 he was captain of the corps of gentlemen-at-arms; in 1885-90 he was governor of New South Wales, in which position he entertained lavishly and set an example that his successors found it difficult to follow; in 1892 he became simultaneously lord chamberlain to Queen Victoria's household and a 'progressive' member of the London county council; in 1895 he was created earl Carrington and viscount Wendover. On the return of the liberal party to power in 1905 he was appointed president of the board of agriculture (1905-11), and afterwards lord privy seal (1911-12); he then retired from active public life with the dignity of marquess of Lincolnshire.

His surname has been a puzzle to journalists for many years. That of his grandfather, the first baron Carrington, was Smith. The second baron in 1839 altered it by royal licence to Carington, and this was confirmed to the third baron in 1880. But in 1896 he changed it again, also by royal licence, to Wynn-Carrington. See Round's *Peerage and Pedigree*. (P.C., 1881; G.C.M.G., 1885; K.G., 1906.)

Ling. See Cod.

Linlithgow, Marquess of. John Adrian Louis Hope (1860-1908), first marquess of Linlithgow, better known to Australians as the earl of Hopetoun, was born at Hopetoun on 25 September 1860 and educated at Eton, succeeded to the earldom in 1873, and spent his adolescence in travel through the East and in America. He took little part in active politics, though he was a minor member of the Salisbury administrations of 1885-6 and 1886-9; in 1887-9 he was high commissioner to the general assembly of the Church of Scotland. In September 1889 he was made governor of Victoria, and officiated during the financial crisis of 1891-3—one result of which was the reduction of his salary from £10,000 to £7000. He made himself very popular (but somewhat incommoded his successors) by unbounded generosity and hospitality, as well as by his genuine interest in racing and hunting. Returning to England in 1895, he was given minor posts in the third Salisbury administration (paymaster-general, 1895-8; lord chamberlain, 1898-1900), and became president of the Institution of Naval Architects. When in 1900 it became necessary to appoint a governor-general for the Commonwealth, Hopetoun's previous popularity and great wealth made the colonial office think him the right man for the place, and on 16 December 1900 he landed at Sydney to take up the position. He figured sumptuously at the inauguration of the Commonwealth on 1 January 1901 and during the visit of the then Duke of York in May and June; but the lavish expenditure which he and those who had appointed him thought necessary was not fully recouped him by parliament, which had fixed his salary at £10,000 and his extra expenditure at another £10,000. Further, his intimation that the salary was insufficient failed to procure an increase; so in May 1902 he resigned, left Australia on 17 July, and returned to England to be made marquess of Linlithgow, and to become after an interval secretary for Scotland in the Balfour administration (3 February to 5 December 1905). Then, the illness from which he had suffered since 1900 increasing on him, he retired into private life and died at Pau in France on 29 February 1908.

He was an ill man throughout his governor-generalship, and no doubt welcomed the early retirement. But the scale on which he felt it fit to keep up his position, both in 1889-95 and 1900-2, was beyond both the wishes of Australians and the competence of many men who would have made excellent colonial governors, and harmed the Commonwealth's reputation—since British officials came to regard Australians as people who demanded wealthy governors and were too mean to pay them adequately. In actual fact, when after Hopetoun's resignation Lord Tennyson took his place and told his ministers that he would spend his salary but not a penny more, they assured him that Australians did not expect anything else; and, when at last that fact was brought home to the colonial office, the selection of governors was made both easier for the British authorities and more satisfactory to Australia. (G.C.M.G., 1889; K.T., G.C.V.O., 1900.)

Lisgar, Baron. Sir John Young (1807-1876), first and only baron Lisgar, was born at Bombay on 31 August 1807, educated at Eton and Corpus Christi College, Oxford (B.A., 1829), and called to the bar at Lincoln's Inn in 1834. From 1831 to 1855 he represented county Cavan in the British parliament, was a lord of the treasury from September 1841 to May 1844, and a secretary to the treasury from that date to July 1846. In 1848 he succeeded to his father's baronetcy. In the Aberdeen ministry of 1852-5 he was chief secretary for Ireland; on 20 March 1855 he was made lord high commissioner of the Ionian Islands, but displeased the populace by his opposition to their wish to be absorbed in Greece, and resigned on 25 January 1859. On 22 March 1861 he was appointed captain-general, governor-in-chief, and vice-admiral of New South Wales and its dependencies. Practically his first official act was to consent to Charles Cowper's proposal for forcing the hand of the legislative council by appointing to it 21 new members (see Cowper, Sir Charles). Regretting this hasty act, he called Wentworth into consultation and made him president of the new council. The passing of the 'free selection before survey' act by the Cowper-Robertson ministry, the introduction of *ad valorem* duties, and the education act passed by Henry Parkes in 1866, are among the notable events of his administration. On 24 December 1867 he left the colony, and on 2 January 1869 was appointed governor-general of Canada. In 1870 he was raised to the peerage as baron Lisgar in recognition of his services. In 1872 he returned to England, and died on 6 October 1876. As governor of New South Wales he distinguished himself by his advocacy of social reforms and his wise guidance of Henry Parkes during that statesman's first administration. (G.C.M.G., 1855; K.C.B., 1859; G.C.B., 1868.)

Lissanthe, a small genus of plants belonging to the family Epacridaceae, endemic in Australia. *L. sapida* (Native Cranberry) has an edible fruit resembling that of the European cranberry in size and colour, but with a much thinner fleshy coating. *L. strigosa* and *L. montana* also have small edible fruit; the berries of the latter are white and transparent.

Literature. Probably everyone who has attempted to discuss the literature of any given country has been perplexed at the outset by the question how much, or how little, may be fairly included under this head. Is the term literature to be restricted to works of pure imagination?

If so, it would tend to exclude historians, philosophers, and biographers, who are nevertheless usually given place in literary histories if they possess any power and grace of style. It is difficult to conceive a history of English literature that should exclude the names of Berkeley, Gibbon, or Macaulay. Perhaps it will be useful in this connection to draw a distinction similar to that used in science, and to speak of 'pure literature' and 'applied literature;' 'pure literature' including all varieties of writing that depend wholly or mainly on imagination, and having poetry, drama, and prose fiction for its main kinds, while 'applied literature' is that in which the imaginative or aesthetic purpose is secondary, and is subordinated to some extraneous end, historical, political, or other. Pure literature is obviously the more important of the two kinds, and the more distinctive of the country which produces it. Indeed, in such a survey as this, applied literature can be only very briefly noticed: and it shall be noticed at once, so that the ground may be cleared for the discussion of the more important kind, and for the general questions connected with it.

It was natural, in a young country of stirring and romantic origins, that attempts should soon be made to record the details of early discovery and development. History has always been a hardy growth in Australia, and some very distinguished Australians have devoted their gifts to telling the story of their country. It has indeed been claimed that Australian literature began in 1819 with Wentworth's *Statistical, Historical, and Political Description of New South Wales*, a work frequently inspired by that passionate hatred of abuses, and that not less passionate nationalism, which were the motive forces of its author's life. Another early historian of New South Wales was John Dunmore Lang, whose narrative (1834: revised and completed, 1875) is written in a strongly partisan spirit. Dr. Lang also wrote voluminously, and as a rule polemically, upon the political questions of his day. Though the most important work of Wentworth and Lang was published in England, both are thoroughly Australian in spirit and outlook. From their time onwards a great deal of Australian history and biography has been written by native-born Australians and by Englishmen domiciled in Australia. The leading general histories are *A History of Australia* by G. W. Rusden (2nd edition, 1897); *A History of the Australasian Colonies* by Edward Jenks (3rd edition, 1912); *A History of Australia* (11th edition, 1925) by Arthur Jose; and *A Short History of Australia* (1916) by Professor Ernest Scott. The last two are written with considerable insight and grace, and are easily the most serviceable works for the student.

Of works dealing with special chapters or individual characters of Australian history only a few can be mentioned here. Into the first class fall *A History of the Colony of Victoria* by Henry Gyles Turner, and *The First Decade of the Australian Commonwealth* by the same author, both written with a strong party bias. Equal bias and greater gusto distinguish *The Making of the Australian Commonwealth* by B. R. Wise. In the second class may be reckoned several excellent biographies of great men; notable among them are those of La Pérouse and Flinders by Ernest Scott, that of Father Therry by E. M. O'Brien, the *Memoir of George Higinbotham* by Professor Edward Morris, and the *Life of Sir George Grey* by Professor G. C. Henderson. The early discovery and subsequent exploration of Australia have their special literature; but no detailed account can here be given of original records (e.g. Flinders's *Voyage to Terra Australis*), or of the narratives of Eyre, Leichhardt, Sturt, Forrest, and other explorers; nor yet of such volumes of research as Ernest Scott's *Terre Napoléon*, dealing with Baudin's French expedition of discovery. Works dealing with the aboriginal races of Australia, such as *Native Tribes of Central Australia* by Sir Baldwin Spencer and F. J. Gillen, and *Native Tribes of South-east Australia* by A. W. Howitt, which rank definitely as literature, are discussed under ABORIGINES.

The legal, sociological, and constitutional writings of Professors Hearne and Harrison Moore and Sir R. R. Garran fall only indirectly under the present heading: but honourable mention must be made of the work done in classical scholarship by Professors Badham, H. A. Strong, T. G. Tucker, and Christopher Brennan; in English scholarship by Professors M. W. MacCallum, John Le Gay Brereton, and W. H. Williams, and by E. H. C. Oliphant; in philosophy by Professors Boyce Gibson, W. Mitchell, and McKellar Stewart; and in literary criticism by Professor Walter Murdoch and A. G. Stephens.

In Australian literature written for its own sake the two outstanding kinds are poetry, lyrical or narrative, and prose fiction. The earliest specimens of Australian poetry are more curious than delightful. There is little worth in the long series of King's Birthday odes by Michael Robinson which began in 1810; in *First Fruits of Australian Poetry* (1819) by Barron Field (friend of Charles Lamb, and judge of the supreme court of New South Wales); or even in *Australasia, an Ode*, by W. C. Wentworth, written in a Cambridge university prize competition, and probably the first poem published by a native-born Australian. Yet interest in poetry was not lacking in the young colony, and the *Wild Notes from the Lyre of a Native Minstrel* by Charles Tompson, junior (Sydney, 1826), which he dedicated to his teacher Henry Fulton (q.v.), are at least more scholarly—in eighteenth century fashion—than much verse published in Australia to-day. The Hawkesbury district, from which Tompson came, must have been a source of inspiration, for the earliest true poet of Australia, Charles Harpur, was born at Windsor on the Hawkesbury in 1817, and lived for the most part in the bush until his death in 1868. His desire for literary fame was eager and constant, and the praise of great poets of the past was his frequent theme: he also made translations from the *Iliad*, and has left a few sonnets, some well-turned. His best, and best-known, poem is 'The Creek of the Four Graves,' which describes an episode of adventure in the bush and so anticipates much of the later verse-product of Australia. Harpur was a lonely singer, and had neither local tradition nor environment to help him. A sweeter voice was that of Henry Kendall (1841-1882), who like Harpur was bush-bred, but spent many of his later years in Sydney and Melbourne. His work is dealt with in detail under his name: here we are concerned mainly with its quality and inspiration. From his youth onwards Kendall maintained a deep and sensitive love for the bush, which appears constantly in his poetry, and helps to give their distinctive beauty to such poems as 'Mooni,' 'The Hut by the Black Swamp,' and 'September in Australia.' He was not a profound or original thinker, nor on the other hand had he watched nature with the

close scrutiny of a Wordsworth: but he had a true and delicate gift of song, and fine emotional sensibility. Perhaps the finest and most moving poem he ever wrote is 'Araluen,' a lament for the death of his infant daughter. Many critics still regard him as the truest poet Australia has yet produced.

If Kendall is the first notable lyrist of the Australian bush, Adam Lindsay Gordon is its first notable ballad-maker. His romantic, daredevil and, withal, melancholy personality, and his preoccupation with adventure and sport, have impressed themselves indelibly on the imagination of Australians: and his spirited and adventurous verse has touched, and will always touch, a responsive chord in their hearts. His best and most individual—though not his most pretentious—work belongs to the class of which 'The Sick Stockrider' and 'Wolf and Hound' are the most famous examples. His 'Romance of Britomarte,' set in the Cavalier period, is a very spirited and well-written ballad. But much of his reflective and dramatic poetry is derivative and inferior, and, despite his vogue in Australia, there is little force in the claim made for him to the title of Australia's national poet. Keenly interested in her life, he was at the same time but a sojourner and an alien within her borders, and only in a very small degree did he help to mould or interpret her national character.

A notable poet who belongs to what may be called the period of transition is Brunton Stephens, who left Scotland and settled in Queensland in 1866. In 1871 he published a long narrative poem, *Convict Once*, which, despite obvious defects, displays a psychological insight all too rare in Australian poetry. In 'The Dominion of Australia' Stephens has left one of the finest patriotic poems ever written in this country. He wrote much miscellaneous verse: his best essay in the comic is 'My Chinee Cook.'

The poetry of Australia, up to the stage now reached, had few characteristics (apart from those of subject) which might differentiate it from verse written in other English-speaking countries. Many of her poets had looked upon her merely with the eyes of interested sojourners in the land: a few had even regarded her as a place of exile. But through the vision and enterprise of J. F. Archibald, the founder (in 1881) of the Sydney *Bulletin*, an opening was provided for men who wished to write of Australia as Australians, and to reveal her spirit and atmosphere through the medium of verse or prose. The influence of the *Bulletin* affected many who never contributed to its pages. Men began to write of Australia no longer as a land of exile, but as their own country, to the making of whose destiny they were eager to contribute. The *Bulletin*, though striving ever toward a fuller nationalism, set its face against sentimentalism, and did not insist that its poets should plaster their pages with local colour, or with indiscriminate praise of their country. Two early writers for the *Bulletin* illustrate the different forms in which the new spirit might find expression. Truly Australian in outlook is Barcroft Boake (1866-92), a poet who, like Gordon, led an adventurous life, and, like Gordon, died by his own hand. Boake's work is uneven, even beyond the wont of Australian poets: but his best verse has a sinister power and an individual rhythm. He, too, responded, though less tenderly than Kendall, to the spell of the Australian bush, of which he has left an impressive picture in the opening of 'A Vision Out West.' It has been contended that the melancholy common to the verse of Kendall, Boake, and other Australian poets is the mere result of a literary convention originally set by Gordon's life and writings, and of his self-inflicted death; but the cause lies far deeper than this. Melancholy is a thing not manufactured out of literature, but springing directly from nature and life.

The most distinctive verse of Victor James Daley (1858-1905), on the other hand, has a glamour that owes little to the scenery or the life of his adopted country, but appears rather as an emanation from that Celtic wonderland that was Daley's true home. His best verse, collected in *At Dawn and Dusk* (1898) and *Wine and Roses* (1911), has peculiar grace and distinction and sometimes achieves an almost Heinesque quality. In sharp contrast with him stand two other poets, Andrew Barton Paterson and Henry Lawson, born respectively in 1864 and 1867. These two are the most widely read of recent Australian poets. Their best work is easy, vigorous, and racy of the bush. Paterson's verse at its strongest is capital band-music. Lawson's has greater intensity, vision, and idea, though his fullest strength has probably been reached not in poetry but in prose. A finer singing quality, with less strength, may be found in the best verse of W. H. Ogilvie, a Scotsman whose temporary sojourn in Australia produced several good ballads and charming lyrics. His 'Bowmont Water' is the best poem of exile ever written in Australia.

Australian after a more austere fashion is Bernard O'Dowd. He is the most intellectual of all Australian poets, and the symbolic revaluations of life which he has embodied in *The Silent Land* (1906), *Dominions of the Boundary* (1907), and *The Seven Deadly Sins* (1909) are always interesting, and not infrequently profound and beautiful. In his long poem, *The Bush* (1912), he expresses eloquently his aspirations for the future of Australia. Many of his admirers must have wished that he would more often exchange the hair shirt of the anchorite for the singing robes of the true poet whom they know him to be at heart. But his strong sincerity, loftiness of aim, and powerful and original imagination should win him honour from every true Australian.

John Farrell (1851-1904) who wrote extensively in the *Bulletin* and published a collection of verse, *How He Died*, in 1887, often showed true power, and in *Australia to England* gave fine expression to his country's national sentiment. A more delicate poetic gift was that of George Essex Evans (1863-1909), who has left verse of beauty and distinction, often inspired by his keen sense of Australia's natural loveliness. The veteran George Gordon McCrae, who was a fellow-contributor with Lindsay Gordon to the *Colonial Monthly*, and published his last volume of verse in 1915, wrote in his earlier days two poems (*The Story of Balladeadro* and *Mamba*) founded on aboriginal legends. His son, Hugh McCrae, is among the first of living Australian poets: his verse displays an elvish imagination, and has a fine singing quality. High place must also be given to Arthur H. Adams, whose earlier verse has force, precision, and beauty. Delicacy, subtle colour, and Celtic glamour distinguish the poetry of Roderic Quinn, who has attained his highest power in short poems, such as 'The Lotus Flower' and 'The Seeker.' E. J. Brady has given us some admirable ballads and chanteys: his most notable volume of verse is *The Ways of Many Waters*.

Several good chanteys have also been written by C. H. Souter, who has a happy knack of both light and serious verse. Edward Dyson's ballads of mining life have much raciness and power. The Elizabethanism of John Le Gay Brereton is reflected in his lyrics and sonnets, which have something of the grace and spontaneity of the 'Great Age.' The fine and individual poems of Christopher Brennan suggest the influence of the French symbolists, in whose work this most learned writer has steeped himself. Delicacy, distinction, and a certain wistful beauty are present in the verse of James Hebblethwaite. F. S. Williamson, though his verse is most uneven, possesses at his best as true a singing quality as does any Australian. C. J. Dennis occupies a place apart in Australian poetry. His best-known work, *The Sentimental Bloke*, is racy and amusing, and has had an immense vogue. He uses slang with piquant effect, and offers a quaint yet authentic presentation of certain aspects of Australian character. A more tragic interpretation of Australian life, in bush and city, may be found in the verse of Louis Esson, who has also written some delightful songs. *An Irish Heart*, by David McKee Wright, contains charming lyrics and ballads. Many of the lyrics in Shaw Neilson's *Heart of Spring* embody their author's keen delight in nature: the best of them have a delicate and exquisite music. Australia has produced several soldier poets; the most notable is Leon Gellert, some of whose lyrics show great power. The sonnet has been much practised in Australia: among her best sonneteers may be numbered Patrick Moloney, William Gay, John Bernard O'Hara, Arthur Bayldon, Louis Lavater, and Zora Cross. Zora Cross is one of the most recent of Australia's woman-poets, notable among whom are also Marie Pitt, Mary Gilmore, and Dorothea Mackellar; the last-named writer's lyric 'My Country' is typically Australian in sentiment and sympathy.

Of the art of novel-writing there have been many practitioners, but few masters. Three books stand out:—*For the Term of His Natural Life* by Marcus Clarke, published serially in 1870-2 and in book form (much condensed) in 1874; *Geoffry Hamlyn* (1859) by Henry Kingsley: and *Robbery Under Arms* (1888) by 'Rolf Boldrewood.' Marcus Clarke arrived in Australia at the age of 18, included in his much varied career banking, bush life, and journalism, and in the end obtained a position in the Melbourne public library. During the 14 years of his greatest literary activity he produced two novels, 12 plays, and many short stories, besides several pamphlets and much miscellaneous journalism. The novel by which he is remembered proved him a great artist in the sinister. In *Geoffry Hamlyn* we are in another world—one of hope and contentment and adventure. Henry Kingsley (1830-1876) for some part of the five years he spent in Australia was forced to rough it as police-trooper and swagman: but his chief novel reflects, in the main, the happier elements of his sojourn, those connected with his residence on a station in the 'Western District' of Victoria. It deals with the adventures of a gently-born but impoverished Devonian, who seeks to repair his fortunes in the great new land of the South: and it presents pastoral life in Australia during the 'forties' as set in a golden age before the rush for gold. Still another aspect of Australian life is presented in *Robbery Under Arms*. 'Rolf Boldrewood'—Thomas Alexander Browne—had a long, adventurous, and chequered experience of squatting, both in western Victoria and the Riverina: he had to face the enmity of hostile blacks, and of more hostile and devastating droughts: and he had been also brought into touch with mining life as police magistrate and goldfields warden in New South Wales. He put all this experience to use in his many novels, and in *Robbery Under Arms* gave the world the most famous story of bushranging ever written. All good Australians are familiar with the Marstons, with the faithful aboriginal Warrigal, and with that dashing Claude Duval of the south, 'Starlight.' Boldrewood's style has obvious defects, and his interpretation of character is downright rather than subtle; but his best work, as represented in this novel and in *The Squatter's Dream* and *The Miner's Right*, has great gusto and swing, and communicates to its readers its author's delight in spirited adventure. His *Old Melbourne Memories* is an interesting and lively record of life in Victoria during and after the 'forties.'

These three books—Clarke's, Kingsley's, and Browne's—stand in a class apart. Novels and stories enjoying considerable popular vogue have also been written by 'Ada Cambridge' (Mrs. Cross), 'Tasma' (Madame Couvreur), Mrs. Campbell Praed, Ethel Turner, Edward Dyson, 'Steele Rudd' (A. H. Davis), J. H. Abbott, Miles Franklin, and Louis Stone. A truer artist than any of these is Mrs. Aeneas Gunn, whose books—*The Little Black Princess* and *We of the Never-Never*—give a vivid and authentic picture of life in the backblocks of northern Australia. Louis Becke did not come to his own till after he had left Australia, but served his literary apprenticeship with the *Bulletin*, to which some of his most brilliant work was contributed. Two writers of Australian short stories stand out from the rest—Henry Lawson and Barbara Baynton. Lawson, whose most widely-read prose volumes are *While the Billy Boils* and *Joe Wilson and his Mates*, has great dramatic force, great strength and directness of style, and the eye of a true artist for the detail and colour of bush life. Australians are sometimes accused of taking their own literature too seriously, and of praising it too highly: it is therefore gratifying to be able to justify the general admiration felt in Australia for Lawson by the testimony of a distinguished foreign critic, Professor Emile Saillens, who gives him enthusiastic praise. Good European judges, he says, 'have not hesitated to compare Lawson in the short story with Bret Harte, Gorki, or even with our own Maupassant.' The best work of Barbara Baynton is contained in her *Bush Studies*, which reveal the more cruel side of bush life with vivid and relentless power; she has probably as much genius as any living Australian author, and her work deserves a place beside that of Ambrose Bierce.

Australian prose writings are for the most part fiction or what has been already denominated 'applied literature:' but a few works deserve mention that can scarcely be classified under either of those headings. Such are E. J. Banfield's *Confessions of a Beachcomber*, first published in 1908, and C. E. W. Bean's *On the Wool Track* (1910), both steeped in Australian atmosphere, the one picturing the warm tropical comforts of coastal Queensland, the other the harder, drier, heat-constrained life of the interior. Two volumes by E. J. Brady—*River Rovers* and *The King's Caravan*—also depict well the colour and humour and adventure of Australian life by river and road.

Of the many plays written in Australia hardly any rank as literature. The repertory theatre movement, instituted with such fine results in Melbourne and Sydney by Gregan McMahon, and in Adelaide by Bryceson Treharne, has given Australia almost its sole opportunity of seeing the best plays of leading European dramatists, and has done its best to encourage local talent; so far, however, it has only produced one dramatist of note—Louis Esson, several of whose plays have been produced in Melbourne. In two of his one-act plays, *The Woman Tamer* and *The Sacred Place,* he portrays Australian slum life with realistic strength and skill; in *Dead Timber* he offers a remarkable study of the tragedy and grim humour of Australian bush life. His longer plays are somewhat less successful, but his best work shows him to be a master of situation and dialogue. Among dramatic work published in Australia, a study of Renaissance Italy entitled *A Man of His Time,* by Helen de Guerry Simpson, merits particular notice for its characterization—a quality not common in Australian drama.

It will be seen, then, that out of the always effervescing literary activity of Australians there has emerged a certain amount of really valuable achievement. Bernard O'Dowd claimed a few years ago that, though Australia so far has produced no poet of the first order, she possesses in several individuals the component parts of such a poet. There is nothing in the conditions of her life to forbid such an one arising. On the other hand, higher standards of criticism —especially of self-criticism—and less of mutual admiration are very urgently needed in Australian literature to-day. At present there is charm, and no lack of it, in our native bush-notes wild: but more than charm, and more than mere cleverness, must go to the making of the great Australian poet or playwright who is still to be.

A. T. S.

Lithgow, WILLIAM (1784-1864), was born in Scotland and educated for the church, matriculated at the university of Edinburgh and became a licentiate of the Church of Scotland. As tutor to the family of commissary-general Allan he went to Heligoland, where Allan procured for him an office in the commissariat department; in 1811 he was promoted to Mauritius, and in 1820 to New South Wales as assistant commissary-general. In addition to his commissariat duties Brisbane in November 1824 appointed him auditor-general of colonial accounts, and he was private secretary to Darling during much of that governor's term, as well as clerk of the executive council during the absence of Colonel Dumaresq, and a commissioner of the clergy and school lands corporation. Darling in 1826 made him a director of the Bank of New South Wales, and Bathurst, in disallowing the appointment, suggested that he be made official inspector with control over the directors. As auditor-general he was appointed an ex-officio member of the legislative council in January 1829, and held the office until January 1843; between 1843 and 1852 he was three times renominated to the new council, and finally left politics in February 1856, when that council ceased to exist on the introduction of responsible government. In 1852 he retired from the auditor-generalship with a pension, and died on 11 June 1864, leaving £1000 to the university of Sydney for a scholarship.

Litsea, a genus of the family Lauraceae, consisting of trees, largely represented in tropical Asia. Six species are indigenous to Australia. *L. reticulata* (Bolly Gum) is a coastal-brush tree of 60-80 feet with a diameter of 2-3 feet; it ranges from the Hawkesbury River in New South Wales to Rockingham Bay in Queensland. It is a handsome shade tree, and produces a useful timber known commercially as bolly gum (this trade-name is, however, used for the timber of several species of *Litsea*). *L. dealbata* (Pigeon-berry) in favourable situations reaches a height of 60 feet; its leaves are pale underneath, with prominent veins, and are frequently found in the playgrounds of the tooth-billed bower-bird. The fruit is reddish-purple, and has an aromatic odour.

Liver-flukes, vernacular name of the class Trematoda of the phylum Platyhelminthes, for which see FLAT-WORMS. They are in shape somewhat like Turbellaria, but have no external cilia. They exist as parasites (external and internal) of vertebrate animals, a few being found in invertebrates, and are provided with one or more suckers by means of which they can attach themselves to their host. They have, for the most part, complex life-histories, requiring the participation of an intermediate host, for a type of which the history of the liver-fluke of sheep will serve.

The adult Liver-fluke (*Fasciola hepatica*) is found in the larger bile-ducts of the livers of sheep fed in damp pastures. It is a flattened, leaf-like animal, upwards of an inch in length, with a triangular head-lobe and two suckers at the broader (anterior) end. It is hermaphrodite and self-fertilized; the eggs, which are produced in enormous numbers, pass by means of the common bile-duct into the alimentary canal of the host, and out with the faeces. Only those eggs which fall into water undergo further development. From these a minute ciliated larva hatches out, swims about freely for a while, then burrows into a pond-snail, and enlarges into a cyst. From the internal wall of this cyst other stages are budded off, which differ according to season. In winter the buds become cysts, which enlarge by the destruction of the mother-cyst, and may continue to proliferate several generations of cysts. In summer bodies known as rediae develop within each cyst, which give rise internally to larva flukes (cercariae), differing from the adult in possessing a motile tail. These cercariae break out from the tissues of the pond-snail, live a free life for a longer or shorter time, and then encyst upon grass bordering the water. When grass bearing such cysts is taken into the stomach of the sheep, the cyst-wall is dissolved, and the young fluke, making its way up the bile-duct to the liver, grows to the adult form. It will be noted that a single egg may, if conditions be favourable, give rise to several hundred flukes by proliferation in the cystic stages. When infection is heavy, the flukes cause a condition known as liver-rot. As the life-history of the parasite demands the presence of standing water and pond-snails, fluke usually occurs only in marshy pastures.

A peculiar group of ectoparasitic trematodes, belonging to the genus *Temnocephala* and its allies, occurs commonly on the surface of Australian freshwater crayfishes, and has been monographed by Haswell (*Macleay Memorial Volume,* Linnean Society of New South Wales). These are somewhat leech-like creatures, with a large sucker at the posterior end; the anterior end is split into five or six finger-like lobes, which are adhesive, and enable the animal to loop along the surface of the host. Trematodes occur in

all classes of vertebrates. The Australian species, other than Temnocephaleae, have been described by S. J. Johnston, W. Nicholl, Harvey Johnston, and O. Tiegs, the first-named dealing particularly with those of frogs, birds, and mammals, and the last-named two authors especially with those of fish.

See *Proceedings* of the Linnean Society of New South Wales, 1901, 1904, 1912, 1915, 1922; *Proceedings* of the Royal Society of New South Wales, 1916; Quarterly *Journal* of the Microscopic Society, 1913; *Parasitology*, 1914, 1915, 1918.

Liversidge, ARCHIBALD, born at Turnham Green near London on 17 November 1847 and educated at the Royal College of Chemistry (exhibitioner, 1867), Royal School of Mines (medallist, and associate in metallurgy and mining, 1870), and Christ's College, Cambridge, was in 1872 appointed first reader in and then professor of geology and mineralogy in the university of Sydney. In 1881 his chair was renamed of chemistry and mineralogy, and in 1891 became one of chemistry only. From 1879 (when the faculty was first constituted) to 1904 he was dean of the faculty of science, and in 1890 founded the school of mines. But his work at the university, valuable as it was, constitutes a small part of his value to New South Wales. He was essentially an organizer of scientific affairs and material. His enduring monument is the Australasian Association for the Advancement of Science, which he founded in 1885, acting as its honorary secretary from 1888 to 1909; from 1875 to 1889 he was honorary secretary to the Royal Society of New South Wales and editor of its journal; he was a member of the first local board of technical education, a trustee of the Australian Museum (1874-1908), and first chairman of the Sydney branch of the Society of Chemical Industry (1903-5). For his untiring work in these directions Cambridge gave him its M.A. degree, Glasgow its LL.D., and the Royal Society of London a fellowship (1882), and he is a fellow of many other learned societies. His only published book is *The Minerals of New South Wales* (1876-82-88), but he has also published many papers on mineralogy and kindred subjects. In 1907 he resigned his chair, and now lives in retirement at Kingston-on-Thames.

Liverworts, vernacular name of a class (Hepaticae) of green flowerless plants, classed with the mosses (q.v.) as bryophytes, which are exceptionally numerous in Australia and Tasmania. Like mosses, liverworts are characterized by alternation of generations, and the plant-body bears the sexual organs; but only the foliose hepatics are liable to be confused with mosses, and the following general points of difference may be noted. (*a*) In hepatics the leaves are usually in two rows, are often bilobed, lack a midrib, and consist of a single layer of cells—whereas the leaves of mosses seldom occur in two rows, and are very rarely bilobed. (*b*) In hepatics the capsule remains within the calyptra until the spores are ripe, and splits longitudinally into (usually) four valves, which are free at the apex; spiral threads (elaters) are generally mixed with the spores; there is no operculum and no columella (except in one family, the Anthocerotaceae), and the seta, or pedicel, is hyaline and fragile.

It is useful to distinguish between hepatics in which the plant-body is a flat thallus, and

Liverworts. (1) *Aneura pinguis.* (2) *Anthoceros punctatus.* (3) *Lejeunea mimosa.* (4) *Jungermannia monodon.*

those in which it is a stem with leaves, after the manner of the mosses. But this distinction can hardly be made a basis of exact classification, because of overlapping forms. The accepted arrangement provides three orders, Marchantiales, Jungermanniales and Anthocerotales.

Marchantiales, of which many species are found in Australia, are all thallose, the thallus consisting of several layers of complex tissues; the sexual organs are usually borne in a more or less umbrella-like receptacle on a long stalk. There are two families, the Ricciaceae and the Marchantiaceae. In the former the sexual organs are immersed singly in cavities of the dorsal surface. We have several interesting species of the genus *Riccia*. The Marchantiaceae are characterized mainly by the stalked umbrella-like receptacle referred to above. The chief Australian genera are *Fimbriaria* and *Marchantia*.

In Jungermanniales (which include most Hepaticae) the plant-body is sometimes a thallus without distinct layers of tissue, sometimes a cylindrical leafy stem. To the former belong the genera *Aneura, Metzgeria, Pallavicinia,* and *Fossombronia,* all occurring in Australia. *Metzgeria* species are of delicate and beautiful structure. To the leafy plants belong numerous genera, of which the most frequently seen are *Trichocolea, Lepidozia, Radula, Frullania, Madotheca, Isotachis, Cheiloscyphus, Cephalozia, Lophocolea, Zoöpsis* and *Plagiochilus. Lepidozia* is often very beautiful in leaf-texture, and *Frullania* and *Madotheca* in their open capsules. Dr. Stephani subdivides the old genus *Lejeunea* into a number of separate genera well represented in Australia.

Anthocerotales represent the highest development among hepatics; they possess a columella, and so approach the mosses. The plant-body is a thallus. The mature capsule dehisces down-

wards by two valves. The single genus (*Anthoceros*) includes several species.

See J. D. Hooker's *Flora Antarctica* (1844-7) and *Flora Tasmaniae* (1860); the *Synopsis Hepaticarum* of Gottsche, Lindenberg and Nees (1844); Franz Stephani's *Species Hepaticarum* (1900 onwards); and articles by F. M. Bailey, R. A. Bastow, Carrington and Pearson, F. von Mueller, L. Rodway, W. W. Watts and T. Whitelegge in the *Proceedings* of the Royal and Linnean Societies of New South Wales and in other scientific journals.

Lizards, vernacular name of the order Lacertilia, the largest group of reptiles to be found in Australia. Lizards may be generally distinguished from snakes by their possessing limbs. Two families, however, contain snake-like reptiles, some species of which have lost all signs of external limbs. Unlike snakes, adult lizards have the two halves of the lower jawbone more or less firmly united in front; most, moreover, have movable eyelids, and a visible organ of hearing that appears externally as a tympanum. They range in size from the tiny skinks, found in the grass or on timber, to the monitors or so-called 'goannas,' the largest Australian species of which reach seven feet in length. Although a few are semi-aquatic, most are adapted to land life. The body is invariably covered with scales. Paired copulatory organs (hemipenes) are present, but these are normally retracted in pockets in the cloaca. Most species lay eggs; but there are many exceptions, and in some the young are born almost as soon as the eggs are laid. The small oval eggs of the common skink are often found amongst rubbish in gardens. Sometimes these are so mature that, when the eggs are purposely broken, the young ones will immediately wriggle out and run away, apparently quite prepared to start life on their own account.

Lizards have a curious organ, situated on the top of the head, which is a very degenerate third eye—the pineal eye. It may often be detected externally, and in the shingle-back skink and goannas appears as a transparent scale, below which the bone is perforated to the brain. In a remarkable New Zealand reptile, the tuatara, this third eye is not so degenerate; and the ancestors of these reptiles, in common with many fossil forms, probably had a functioning third eye.

In the belly, near the hind-limbs, there are present in many lizards the so-called 'fat-bodies;' these in the goanna attain a large size, and are considered by some people to possess medicinal properties. No Australian lizard is venomous, but many are armed with sharp teeth set in strong jaws; as they feed on decaying material, a bite may convey poison to the blood of the victim. The great majority, however, are harmless, and useful as insect destroyers.

Australia has more than 200 species of lizards, included in five families: the geckos (Geckonidae), the snake-like pygopodes (Pygopodidae), the dragon-lizards (Agamidae), the monitors or goannas (Varanidae) and the skinks (Scincidae). No chameleons are indigenous to Australia; a few have been introduced as pets from South Africa.

Geckos are represented by about 50 species. In a typical species the body-scales are soft, often accompanied by granular tubercles. The toes of many terminate in adhesive disks, by the use of which they can walk up walls and windows, and even run across the ceiling; these disks are soft and elastic, and adherence is gained by pressing out the air and forming vacua, not by stickiness. The eyes are covered with transparent skin, the true lids being rudimentary. A healthy specimen will shed its outer skin in a complete slough periodically. Most species have a soft, 'clicky' voice: the word 'gecko' is an attempt to represent the sound made by a common species. The tongue is fleshy, and slightly divided in front; the tail is often curiously shaped, and usually very brittle. When a bird or snake attacks a gecko, it often seizes the prominent tail, which falls off and wriggles, thus attracting the pursuer, whilst the lizard runs away. In a few months a new tail is grown, usually quite unlike the original. A brittle tail is thus a distinct advantage. Most geckos are nocturnal, and devour large quantities of insects. In country districts they make themselves at home in dwellings.

In the Barking Lizard (*Nephrurus asper*) the tail ends in a ball. This gecko has a big head, large eyes, a rough skin with pointed tubercles, and long, angular legs, and is about five inches long; it has the habit of raising itself to the full stretch of its legs, and then lowering the body nearly to the ground; this is done repeatedly. When disturbed, it often gives a short

Barking Lizard.

side-spring and emits a cough-like bark, from which its name is derived. Its bite is not harmful. In captivity it feeds on small grasshoppers and other insects. Specimens are occasionally found in northern Queensland and central Australia, whilst a species with a smoother skin has also been described. In the Leaf-tailed Gecko (*Gymnodactylus platurus*), a larger species found in New South Wales and Queensland, the tail is flattened. A closely-allied form with markedly protective colouring resembles the lichen-covered bark of a tree. These have no adhesive disks to their digits. Some are very handsome, *G. miliusii* being chestnut-brown above, with white cross-bands. Because of their grotesque appearance certain geckos, though harmless, have been given the inappropriate name of 'wood adder.' The genus *Diplodactylus* contains no less than 20 species; a familiar one (*D. vittatus*) is sometimes, from the pattern on its back, called the carpet gecko. The Ribbon-tailed Gecko (*G. taenicauda*) has a curious streak of tawny colour on the tail. Several species of *Oedura* are commonly found under the loose bark of trees. *O. tryoni* is a handsome species with ocellated spots on the back.

In several respects our most interesting family is the Pygopodidae, confined to Australia and

LIZARDS, SNAKES, AND FROGS

Plate XXIV

Drawn by P. Flockton Clarke.

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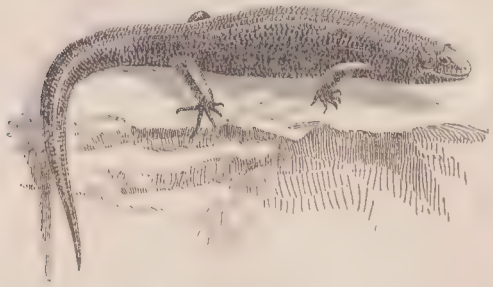
1. Green Frog (*Hyla caerulea*).
2. *Limnodynastes tasmaniensis*.
3. Lace Monitor (*Varanus varius*).
4. Frilled Lizard (*Chlamydosaurus kingii*).
5. Black-and-white Ringed Snake (*Furina occipitalis*).
6. Death Adder (*Acanthophis antarcticus*).
7. Black Snake (*Pseudechis porphyriacus*).

used to pick them up. The Water Dragon (*Physignathus lesueuri*), a large lizard, is occasionally found near water in the eastern States; it grows to over three feet in length, and is possibly the reason why 'young crocodiles' have been allegedly seen in the southern parts of Australia. Several large, compressed scales form a crest along the upper neck, which is continuous with a smaller series that crests the body.

The Varanidae (monitor lizards) are in Australia popularly called goannas: this word is a corruption of 'iguana,' but—since the true iguanas are not found in Australia—has been adopted as an independent name for Australian monitors. The skin of these lizards is covered



Land Mullet.

with small scales and tubercles; the tongue is very long, divided in front, and can be put forth for a considerable distance as an organ of investigation; the teeth are sharp, and are attached to the inner side of the jawbones. Fingers and toes are armed with sharp claws, useful in climbing. A common species is the Tree Goanna or Lace Monitor (*Varanus varius*), which grows to at least six feet, and is a great climber. Its prevailing colours are black and yellow; it may be readily distinguished from *V. gouldii* (which is more characteristically a ground form) by the presence of alternating black-and-yellowish bands on the tail. These goannas are great robbers and scavengers, devouring any dead or living animals they can secure, and are very fond of birds' eggs, including those of the domestic fowl. A specimen of *V. varius* in the Queensland Museum was found with a native porcupine partly swallowed. Goannas lay about a dozen eggs with tough shells, of oval shape and above two inches in length. Fourteen species have been described.

The skink family (Scincidae) is by far the largest family, and includes a variety of forms, from little lizards that run in the grass and on fences to species of *Egernia* which are fully two feet long. Most have well-developed limbs, and are clothed with smooth scales, but a few are prickly and spinous. The giant of the family is *E. bungana* (sometimes called Land Mullet), a shining black skink which grows to over two feet and is found in the mountain scrubs of eastern Australia. After wet weather it may be seen lying out in the sun on logs. There are about 10 other species, of which two from the western and central regions have spiny tails. *E. cunninghamii*, not uncommon about Melbourne and Sydney, is a prickly species about a foot long. The blue-tongue lizards are clumsy, smooth-scaled skinks with short limbs and a bluntly triangular head. They have been mistaken for death adders by careless observers. The commonest, *Tiliqua scincoides*, grows to about 18 inches. In captivity this will feed on raw meat, and is known to eat fungi. The blue-tongue lizard and some species of *Egernia* will emit violent blasts of breath when disturbed, this being caused by a muscular, bellows-like movement of the body. An allied skink, *Hemisphaeriodon gerrardi*, has a long tail which is somewhat prehensile—a very unusual characteristic of this family. The Shingle-back or Double-headed Lizard (*Trachysaurus rugosus*), considered our ugliest lizard, grows to about 15 inches, and is very sluggish. The tail is short, broad, and almost as large as the head. The scales on the back are large and thick: as they overlap considerably, the name 'shingle-back' is appropriate. The lizard is in reality armour-plated, as each thick scale hides a bony plate. Specimens are often infested with ticks (not cattle-ticks). In captivity the shingle-back will eat raw meat, which at first it investigates with its dark purple tongue. The young are brought forth alive, and are of astonishing size, being nearly half as big as the mother. The genus *Lygosoma* contains a large number of skinks, greatly varying in size and structure. Some of the smaller forms have on the lower eyelid a transparent space which forms a little window. These lizards can thus close their eyelids and still look out. In this genus we get all stages of limbs, from lizards with well-developed legs, each supplied with five

Blue-tongue Lizard.

Lygosoma punctatovittalum

toes, to worm-like or snake-like reptiles in which all external signs of limbs have disappeared (*L. ophioscincus*). The number of toes is variable, some species having tiny stumps with no digits. In several there is no external sign of an ear. One of the commonest, *L. verreauxi*, grows to over a foot; on the small forelimb there are three small divisions or toes, whilst the still smaller hind-limb is a simple stump. This lizard is often found under logs, and is dark-brown above with a white band at the back of the head. Another, *L. punctatovittatum*, is illustrated here. The majority of skinks are brown, with a brilliant sheen in sunlight, and often have an elegant pattern of darker markings. One of the largest is *L. lesueuri*, a handsome lizard with white-edged black bands along the back and upper parts of the sides, and with white spots. It grows to nearly a foot, and is very swift. Some skinks have fragile tails, which grow again if partly broken, and form a bifurcated or so-called double tail; more rarely specimens are seen with three divisions to the tail. Skinks of the genus *Ablepharus* have a transparent disk covering the eye. *A. boutoni* is a very common, agile lizard, marked along the body with black-and-white bands which have gained for it the name 'railway lizard.' It is found on fences, where it preys on flies. H.A.L.

Lobster. See CRAYFISHES.

Local Government. In every State of the Commonwealth a system of local government is in operation. Generally speaking, local authorities exercise their powers under (*a*) constituent acts by which they are created and empowered to carry out necessary functions, and (*b*) general acts, each dealing with a single subject or group of subjects, which give them administrative authority for the purpose of such acts. But in Australia general acts are usually administered directly by local officers of the central government, e.g. those relating to education, police, etc. The system of local government in operation here, as in England, is based on the principle of a grant of specific powers by the State legislatures to the local authorities; their autonomy is, however, more or less limited by the provision which is made for general supervision by a department of the central government or by the governor-in-council. Otherwise, within the scope of the acts under which they are constituted or which they have to administer, they are responsible only to the ratepayers. The cities of Sydney, Melbourne, Geelong, Hobart, and Launceston, incorporated under separate acts, stand outside the general scheme. The powers and responsibilities of local bodies are in general similar in all the States, and cover such matters as the upkeep and construction of roads and bridges (see ROADS AND BRIDGES), water and sanitary services except in the chief cities (see WATER SUPPLY AND SEWERAGE), lighting, and the administration of the dog acts, food and drugs acts, slaughtering acts, weights and measures acts, width of tires acts and similar measures. There are also a number of functions which local authorities may perform, either with or without the consent of the ratepayers or the governor-in-council; e.g. they may establish hospitals, recreation grounds, libraries, museums, and transport facilities, provide asylums, and support charitable institutions; they may also obtain additional powers for special undertakings by means of special acts. As regards the election of officers, methods of valuation and rating powers, the systems differ considerably in the several States. A system of local government was in operation in Western Australia in 1838, though not on an elective basis; the first elective body in Australia was the municipality of Adelaide, which was incorporated in 1840.

New South Wales.—The first act which provided for any degree of local government on an elective basis was the parish roads act of 1840, under the provisions of which one-third of the proprietors of lands through which, or within three miles of which, a parish road passed, could requisition the magistrates in petty session for authority to elect trustees who were empowered to levy a rate not exceeding 6d. per acre, to buy, sell, or exchange lands, to appoint surveyors, to establish toll-bars and tolls, and let them on lease for a period not exceeding one year, and to borrow money for the purposes of road-making and repairing. During 1842, by the Imperial act for the government of New South Wales and Van Diemen's Land (see CONSTITUTIONS), the governor was empowered to constitute district councils with local functions, the revenue for which was to be raised by rates levied within each district. The qualifications for councillors and electors were respectively the same as those for members and electors of the legislative council. The duties of these councils covered the construction and upkeep of roads, streets, bridges, and public buildings; the establishment and support of schools; the making of orders-in-council; the purchase, sale, and management of property; the provision of means for defraying such expenses connected with the administration of justice and police within the districts as were by law directed to be defrayed by the district. But this comprehensive scheme of local government was strongly opposed in the colony because it involved payment by the proposed councils of half the police expenses, though the governor retained full control of the police force; it was therefore only partially enforced. Under its provisions Appin, Campbelltown, Camden, Narellan, and Picton were in 1843 incorporated under one district council, Appin and Campbelltown being later constituted separate districts, and by 1844 there were eight district councils in New South Wales; but, with the exception of certain road-trusts especially established, no further extension of the principle of local government took place in that colony until 1858, when the municipalities act was passed. It provided for the incorporation of any town or rural district as a municipality upon petition from 50 resident householders, unless a stronger counter-petition were made. Every ratepayer was eligible as elector or councillor. The municipal revenue was derived from tolls, from a general rate not exceeding 1s. in the £ on the assessed annual value, and from special rates for sewerage, etc. Provision was also made for a government subsidy for 15 years after incorporation. Under the act 35 districts were incorporated, and of these 33 still exist. An act of 1867 repealed the act of 1858 and provided for the classification of all future municipalities into boroughs or municipal districts; existing municipalities were classified as boroughs. Any city, town, or suburb of the metropolis, or of any populous country district, might be constituted a borough if it had a population of not less than 1000 and an area of not more than nine square miles, of which no part was more than six miles distant from any other part; any part of the country not containing a borough, and having

an area of not more than 50 square miles and a population of not less than 500, might be constituted a municipal district. Incorporation was on a voluntary basis. Plural voting for aldermen was allowed. This act with its successive amendments was consolidated in 1897, but no new principle was introduced until the shires act was passed in 1905. The voluntary system—which had been very unsatisfactory, only 2830 square miles being incorporated in 1906 out of a total State area of 310,367 square miles—was abandoned; the State, with the exception of existing municipalities and the western division, was divided into shires, and these subdivided into ridings with equal representation in the shire council, in which wide general powers were vested; the rates, which were to be not less than 1d. nor more than 2d. in the £, were no longer to be charged on the annual rental but on the unimproved value of land, and as soon as they were imposed the operation of the State land tax act ceased. The principles embodied in the shires act were extended to municipalities by the local government extension act of 1906, by which the distinction between boroughs and municipal districts was abolished and the governor empowered to proclaim as a city any municipality which had, during the five years preceding such proclamation, an average population of at least 20,000 and an average revenue of at least £20,000, and which formed an independent centre of population. A local government act of 1906, consolidating the acts governing shires and municipalities, came into operation on 1 January 1907; it was amended in 1907 and 1908, and was repealed by the local government act of 1919, which continued and improved the system adopted in 1906. Provision was made for the continuation of existing shires and municipalities, for the creation of new ones, and for their reconstruction by uniting, dividing, altering, or converting areas. Provision was also made for the constitution of a larger municipal unit by empowering municipalities or shires to join in creating county districts; four county districts (St. George, Richmond River, Clarence River, and Southern Riverina) have since been formed by municipal and shire councils co-operating for specific purposes. It was also deemed advisable to provide for municipal units smaller than the shires, and under the act any village or town in a shire may be proclaimed an urban area, with a committee of three members exercising certain powers locally under the supervision of the shire council. There are 75 urban areas now in existence.

Under the act each shire is divided into three ridings, and each municipality may be divided into wards by petition of the council (or a majority of the ratepayers) to the governor. A shire council consists of either six or nine councillors (presided over by a president), and a municipal council of six to twelve aldermen (presided over by a mayor) with certain exceptions. The election of councillors takes place simultaneously throughout the State every three years. All adult owners or rent-paying occupiers of rateable property of a minimum annual value of £5, who are either natural-born or naturalized British subjects, are entitled to the municipal franchise, and any person so enrolled (unless otherwise ineligible) is qualified for election as councillor or alderman; women were made eligible by the women's legal status act of 1918. The local authorities are empowered to construct and maintain roads and streets, to provide a public water-supply and sewerage or sanitation system, to supervise the public health and enforce the public health acts, to carry out town improvement schemes, to regulate the erection of buildings, to provide and maintain public reserves, parks, baths, libraries, hospitals, etc., to manufacture and supply gas, electrical or hydraulic power, to provide telephone services for outlying districts, to acquire and preserve places of historic interest or scenic attraction, to control the plucking of wild flowers, to keep rivers and watercourses free from obstruction, to impound straying animals, to regulate burials and cremations and provide cemeteries and crematories, to establish public markets, weighbridges, wharves, abattoirs, sheepdips, inland watering-places for travelling stock, etc., to regulate the sale of fish and meat, to license vehicles, to build light lines of railway and tramways and maintain ferries, to build and sell houses for working-men, to provide and manage employment registries, to compel the destruction of noxious weeds, etc. The powers of local bodies in the other States correspond on the whole to those exercised in New South Wales, and will not be separately indicated.

All land (except public parks, the sites of charitable institutions, unoccupied crown lands and similar areas) is rateable in New South Wales. Four kinds of rates are levied. In shires a general rate of not less than 1d. nor more than 2d. in the £ is levied on the unimproved capital value of land, power being vested in the governor to sanction a rate of less than 1d. if the proceeds more than suffice to meet the needs of the council. The municipal general rate must be not less than 1d. in the £ and not more than is required to yield a sum not exceeding the amount that would be derived from rates of 2d. in the £ on the unimproved capital value and of 1s. 6d. in the £ on the assessed annual value of all rateable land. Special and local rates may also be levied on either the improved or the unimproved value, but a poll may be demanded by the ratepayers to decide the basis of assessment. If a council proposes to raise a special loan, it must levy a loan rate sufficient to provide a sinking-fund as well as interest; 25 per cent of the ratepayers may demand a poll on the question whether a loan shall be raised and whether the loan rate shall be levied on the unimproved or the improved capital value. The total of all rates must not exceed the amount that would be yielded by rates of 2d. in the £ on the unimproved capital value and of 2s. on the assessed annual value; but this maximum may be exceeded with the special permission of the governor. Profits made on public undertakings must not be used to reduce rates. Government grants may be made to municipalities and shires for specific purposes; in addition a government endowment of not less than £150,000 is distributed annually among the shires, the amount paid to each shire being determined according to the extent of the shire, the necessary expenditure, etc., and paid on the basis of the amount of general rates collected in the preceding year. In 1922 a sum of £156,861 was paid as government endowment. Both shires and municipalities have borrowing powers within a limited range. A uniform system of accounts is prescribed, and all town and shire clerks are required to hold certificates of competency issued by a committee appointed under the local government act. If a local government area defaults under the terms of the act, the governor

is authorized to appoint an administrator for such area. The act is administered by the local government department, which was first constituted as a branch service when the 1906 act was under consideration, and has since been made an independent department with a ministerial head. The autonomy of councils is limited by the authority of the department, which not only acts as an intermediary between the councils and the governor in regard to proposals requiring the governor's assent, recommends the basis of distribution of government subsidies, and finally determines the alteration of boundaries, but also directly supervises local borrowings, inspects the annual balance sheets, and exercises a certain amount of vigilance to see that members do not engage in trade with their own councils; it may also grant or withhold authority to levy rates in excess of the legal maximum, to sell land held by the council, to exercise powers under the native dogs and poisoned baits act of 1901, etc. The department further makes available to councils its expert engineering staff, assists them with advice on town-planning, and collects and collates information.

The city of Sydney was incorporated in 1842. In 1849 a select committee reported that the city council had 'entirely lost the confidence of the citizens, and was regarded as an impediment to the improvement of the city;' it recommended that the corporation be dissolved, and its powers vested in three commissioners. A resolution embodying these recommendations was defeated in the legislative council in 1849; but in 1853 (after further consideration by a select committee in 1852) the corporation was dissolved and three city commissioners were appointed by the governor. In 1857 self-government was restored.

The city is now (1925) divided into 13 wards, each returning two aldermen; the franchise may be exercised by any adult natural-born or naturalized British subject who is (*a*) the owner of freehold property assessed at not less than £5, or of a leasehold of an annual value of £25, or of a house, shop, etc. of the value of £10, (*b*) has been a lodger continuously for six months and occupied lodgings of the value of £10 or upwards. Any enrolled adult is eligible for election as alderman; women are qualified under the women's legal status act of 1918. In 1908 the city council was empowered to assess general rates on the unimproved capital value instead of on the improved value, and under these conditions the levying of the land tax was suspended. The general rate must not be less than 1d. in the £ in addition to any other rate, but the total amount of all rates levied must not exceed 3d. in the £ on the unimproved value, or 2s. in the £ on the average annual value. The city is not subject to the supervision of the local government department.

Under the fire brigades act of 1909 municipalities in New South Wales contribute, equally with the colonial treasurer and the insurance companies, to the expenses of the board of fire commissioners which was then created and given jurisdiction over the eight fire districts into which the State was divided; but expenditure must be so regulated that the proportion payable by the councils in any fire district must not exceed the amount obtainable from a rate of one farthing in the £ on the unimproved capital value of the district. The contribution of the municipalities in 1922 was £53,979.

The total area of the State incorporated at the end of 1922 was 183,985 square miles, 2845 square miles in municipal areas and 181,140 in shires. There were 185 municipalities, with a total population of 1,471,020, an unimproved capital value of £123,823,897 and an improved capital value of £349,902,171; and 136 shires, with a population of 688,560 and an unimproved capital value of £135,380,748.

Victoria.—Until 1850 Victoria then known as the Port Phillip district, was under the jurisdiction of New South Wales, and Melbourne and Geelong were incorporated under special acts of the New South Wales legislative council in 1842 and 1849 respectively. The Imperial act of 1850, which created the colony of Victoria, empowered the governor to proclaim districts under the Imperial act of 1842 upon petition of the inhabitants, and to establish elective district councils with power to make by-laws for constructing and maintaining roads and bridges, establishing schools, and levying local tolls and rates. The clause requiring a district council to provide half the cost of maintaining the police within its district was deleted. But a more comprehensive scheme of local government soon became necessary to meet the needs of a rapidly growing population, and in 1853 there was passed a roads act which (*a*) made provision for the creation of a central road board for the care of main roads, and (*b*) authorized the governor to divide the colony into road districts within which local boards responsible for parish roads and with power to levy local rates might be elected by resident property-holders. This act, which made provision chiefly for local government in country districts, was repealed in 1863, when a road districts and shires act was passed. The central road board was abolished; any road district having an area of not less than 100 square miles and a revenue from general rates of not less than £1000 might be incorporated into a shire, with powers additional to those of the district, including the right to raise loans and grant licences. An act of 1854 had already provided that any district having an area of not more than nine square miles, no part of which was more than six miles distant from any other part, and having a population of not less than 300 persons, could be incorporated into a municipal district or borough. The principal clauses of this act were consolidated (with amendments) in the boroughs statute act of 1869. The provisions of both the shires statute act and the boroughs statute act were consolidated by a local government act of 1874, which after further amendments was itself consolidated by the local government act of 1890. In 1899 a select committee (later constituted a royal commission) was appointed to enquire into the local government system then in operation; to its report, issued in 1902, was attached a draft bill which became the local government act of 1903, consolidated with amendments in 1915. Under this act provision is made for the continuation of municipalities already established and the incorporation of others. Any part of the State returning from rateable property, at a rate not exceeding 1s. in the £, a sum of £1500 may be constituted a shire upon petition of at least 50 inhabitants; any area not exceeding nine square miles and with no point more than six miles distant from any other point, and having a population of not less than 500 resident householders and rateable property yielding from a rate not exceeding 1s. in the £ on annual value a sum of £300, may

be constituted a borough upon petition of at least 250 householders; any area not exceeding three square miles in extent in any shire and distant more than ten miles from the city of Melbourne, may be proclaimed a township upon petition of 25 ratepayers. In municipalities the number of council members is a multiple of three, not less than six nor more than 24; if the area is subdivided, three councillors represent each subdivision. Any male adult holding property of the rateable value of £20, unless otherwise ineligible, may be elected a councillor. The councillors elect their own chairman, who in cities, towns and boroughs is called the mayor and in shires the president. Every adult (except non-naturalized Chinese) with property rated at £5 a year, or on which there is a dwelling-house, may exercise the local franchise providing that rates have been paid three months or more before elections and that the occupier and the owner of any rateable property are not both enfranchised in respect thereof, the former having the prior right to enrolment. Corporations liable to rates may enrol in their stead not more than three persons; joint occupiers and owners not exceeding three are each entitled to enrolment. Plural voting is allowed on a fixed scale. All land (including buildings and improvements thereon) within a local government area is with certain exceptions rateable property, the valuation of property being computed at its net annual value (that is to say, at the rent at which it might reasonably be expected to let from year to year free of all usual tenant's rates, taxes and cost of maintenance), providing that the sum so computed be not less than five per cent upon the fair capital value of the fee-simple. A council may, however, with the consent of the ratepayers—obtained, if required, at a poll—levy rates on the basis of the unimproved capital value of the land, and adopt the valuation made by assessors under the land tax act of 1915. The councils may levy general, extra and special rates. General rates must not exceed 2s. 6d. in the £, nor be less than 6d. in the £, on the net annual value, and must be levied on the occupier of the property rated—or, if there be no occupier, or if the occupier be the Crown or some public authority or body, then upon the owner of the property. Extra and separate rates may also be levied under given conditions. The councils may borrow money to a limited sum. The government endowment to boroughs and shires is based by law on the annual amount of general and extra rates received; no city or town is entitled to such assistance. In 1922-3 government endowment amounted to £50,000, and an extra sum of £64,340 was paid as the equivalent of licence fees, etc., incurred under the licensing act of 1915. The whole State (with the exception of French Island) is now subject to the provisions of the local government act, though the cities of Melbourne and Geelong, incorporated under separate and early acts, are subject to it only in a few details.

Melbourne, incorporated as a town in 1842, was proclaimed a city by letters patent on 25 June 1847, an act to that effect being passed in 1849. The city is now divided into eight wards, each represented by one alderman and three councillors. The lord mayor is elected annually by the councillors and aldermen from among their number, and the councillors (elected for three years) choose aldermen who hold office for six years. Two assessors for each ward and two auditors for the city are elected annually. The qualifications for councillors, assessors and auditors are that they be male adults in possession of real or personal estate to the value of £1000 or assessed in respect of rateable property having an annual value of £50. The franchise may be exercised by adults occupying any house or shop of an annual value of £10, and by resident householders in the city or within seven miles thereof. Plural voting is provided for. Geelong, incorporated as a town in 1849, was proclaimed a city in 1910, the acts passed for Melbourne being made applicable to Geelong. In 1923 there were 53 cities, towns and boroughs and 139 shires incorporated in Victoria. Victoria is divided into a metropolitan fire-district (under a metropolitan fire brigades board) and nine country fire-districts (under a country fire-brigades board). The municipalities are represented on the boards, and contribute to their expenses.

Queensland.—Shortly before the separation of Queensland in 1859, Brisbane was incorporated under the New South Wales municipal corporations act of 1858. In 1864, by a Queensland municipal institutions act, the governor of the new colony was empowered to incorporate as a municipality any city, town or rural district with a population of not less than 250 inhabitants on the petition of at least 100 resident householders. Powers vested in the councils included the construction and maintenance of roads, bridges, ferries, cemeteries, baths, water-supply, lighting and sewerage, and the prevention of the erection of easily inflammable buildings in 'first-class divisions.' The provincial councils act of the same year (1864) empowered the governor, on petition, to proclaim any portion of the colony a province, and to appoint a council of not less than three or more than nine members. Only one council was constituted under the provisions of this act, and it soon collapsed. During the seventies certain road trusts were also established, though without legislative sanction, to effect minor improvements. No new principle was introduced until 1878, when a local government act made provision for the compulsory incorporation of municipalities and for the division of rural areas into shires of the Victorian pattern. But this shire-system was found to be unsuited to the conditions of a sparsely populated country, and in the following year a divisional boards act authorized the governor to constitute any portion of the colony outside existing municipalities a division, with a board of not less than three nor more than nine members. Provision was made for postal voting. The act was applied to about 660,000 square miles of territory, which was cut up into 74 divisions, some of vast extent and very sparsely populated. The new boards were to be subsidized by the government to the amount of 1s. in the £ on the annual value, plus an endowment equal to £2 for every £1 of rates collected for a period of five years and thereafter £ for £. Should a division fail to elect its board, the governor was empowered to nominate members; of the new divisional boards about half were appointed in this way. The divisional system with certain amendments (e.g. in 1890 provision was made for the levying of rates on the unimproved capital value of the land instead of on the annual value) was retained until 1902, when a local authorities act was passed; this act with amendments now constitutes the principal act. Under its provisions the whole State is incorporated into cities, towns, and shires; all municipalities

formerly constituted as boroughs are towns, all shires and divisions are shires. The act declares Brisbane, Rockhampton, and Townsville to be cities and empowers the governor to proclaim other cities—the city of South Brisbane was proclaimed in 1903. The power to alter municipal boundaries lies entirely with the governor-in-council, who may act on his own initiative. Local authorities may constitute joint boards to exercise certain specific powers of the constituent local authorities. Town councils consist of seven, nine or eleven aldermen—or, if the area is divided into wards, of three aldermen from each ward; shire councils consist of five, seven or nine councillors, or, if the shire is subdivided, of not more than three from each division. Members are elected for three years; one councillor from each ward retires annually in a divided area and a fixed proportion of councillors in an area that is not divided. On petition of at least one-fifth of the ratepayers the governor may dissolve the council and order a fresh election. The municipal franchise is extended to all adult natural-born or naturalized British subjects within the jurisdiction of the local authority, plural voting being provided for; with certain exceptions every enfranchised adult, wherever his residence, is qualified for election as alderman or councillor. All land (except unoccupied crown land, land used for public purposes, etc.) is rateable, both general and special rates being levied on the unimproved capital value, which must be determined at least once every three years in a town and once every five years in a shire. The general rate must not exceed 6d. in the £ nor fall below ½d.: special rates must not exceed 3d. in the £—but this provision does not include separate rates, special water rates, loan rates, cleaning rates or tramway rates. The councils are empowered to raise loans; there are practically no government subsidies. The municipalities contribute towards the maintenance of local fire-brigades. The central administrative authority is divided between different departments, the chief being the home secretary's department which administers the constituent acts. Certain powers of supervision and control are reserved to the central departments. In 1922 there were in Queensland 36 cities and towns and 134 shires, the former having a total area of 522 square miles and a population of 343,799 and the latter an area of 669,372 square miles and a population of 427,739. The capital value of the cities and towns was £19,486,391, and of the shires £50,284,568.

In 1924 was passed an act for the good government of the city of Brisbane, which, like other cities of the State, had previously been subject to the provisions of the municipal acts. Provision was made for the creation of a new city area from the amalgamation of the cities of Brisbane and South Brisbane, six towns, 10 full shires and parts of two other shires. The city council consists of 20 aldermen, each representing a different ward, and a mayor chosen by the electors of the city voting as one electorate. The first election was held on 21 February 1925, and the council met on 18 March; but it will not exercise full powers until October 1925, when various boards constituted under the local authorities act, the health act and the electric light and power act will be dissolved.

South Australia.—In this State the settled districts are controlled for purposes of local government by two types of local authorities, which function under separate acts—municipal corporations and district councils. Large areas of the State are still unincorporated. A system of main road boards was established in 1849, but they were abolished in 1887; their powers were vested in the corporations and councils. In the third annual report (1839) of the colonization commissioners for South Australia a recommendation was made that towns with 2000 inhabitants should be given municipal institutions; an ordinance was therefore issued in 1840 for the incorporation of Adelaide. In 1849 a municipal corporations ordinance empowered the governor to incorporate, on petition of not less than two-thirds of the resident householders, any town, village, or hamlet with certain exceptions; but only five municipalities, exclusive of Adelaide, had been constituted when the ordinance was repealed in 1861 by the municipal corporations act. Under this act the governor was empowered, on petition, to proclaim any place a municipality; municipal corporations were authorized to maintain streets, common sewers and water-works, to levy water-rates, to control public slaughter-houses and markets, to contract for cleansing and the removal of night-soil, and to organize fire-brigades, etc. A consolidating act of 1880 was in turn consolidated by the municipal corporations act of 1890, which is still the principal act relating to municipalities, though it has been amended several times. Under its provisions the governor is empowered to constitute new municipalities, or to alter the boundaries of existing ones, on petition of not less than two-fifths of the ratepayers or owners of rateable property concerned, provided that the value of rateable property therein is sufficient to produce at least £300 per annum from the general rate; he may also re-arrange, increase or diminish the number of wards of a municipality on petition of not less than one-fifth of the ratepayers therein. The first district councils act (passed in 1852) empowered the governor on petition to constitute districts; all occupiers, owners and tenants were qualified to vote for a council of five members, who were given control of the roads within the district, and were authorized to license pounds, to issue slaughtering, depasturing and timber licences, and to nominate persons to serve as constables each year. This act with amendments was consolidated by the district councils act of 1858 (which gave additional powers to the councils), but no important alterations were made until 1887. Plural voting was then abolished; drainage boards were merged with the councils, which were also vested with the powers previously exercised by the main roads boards and with other new powers. In 1914 a district councils act repealed all acts relating to district councils; this with amendments is still in force. It provides for the continuation or amalgamation of existing districts and for the incorporation, on petition, of any area not held under pastoral lease, containing rateable property capable of yielding £200 on a rate not exceeding 1s. in the £, providing that the petition be signed by 50 inhabitants—or, if the area concerned comprise part of an existing district, by a majority of the ratepayers, providing that such majority owns or occupies more than half the rateable property. Municipal corporations consist of a mayor for the municipality and of two councillors for each ward therein, elected by qualified voters; on petition of the corporation, confirmed by a poll of ratepayers, the governor may proclaim that the portion of the act relating to aldermen is to be applied, whereupon

aldermen elected by the whole municipality are added to the councillors. District councils consist of five to ten councillors, who elect a chairman from among their number. Every adult ratepayer (women were included in 1914), with certain exceptions, is qualified to be elected either to a municipal or district council; the local franchise may be exercised by every adult ratepayer, but in municipalities aliens may not vote. In municipalities voters have one vote for each ward in which they have property. Rates are levied in municipalities on the rent at which property would let for seven years, with a minimum of 5 per cent of the total value. In districts, all land outside townships and all occupied land or buildings within them are assessed at four-fifths of the gross annual rental at which they would let for seven years or at 5 per cent on the capital value of the fee simple; town lands unbuilt on are rated at 5 per cent of their value, and mining land leased from the crown on a valuation that must not exceed their annual rental. Municipal corporations may declare a general rate not exceeding 1s. 6d. in the £, a lighting rate not exceeding 4d., a rate for the improvement of park-lands, squares and reserves not exceeding 3d., and a fire-brigades rate not exceeding 3d.; a watering rate may also be levied. With the consent of the ratepayers special rates may be levied, providing that the total rate does not exceed 2s. in the £. In districts rates are of five kinds: general, special, separate, differential separate, and watering; the general rate must not be less than 1s. nor more than 2s. in the £ on the assessed annual value. Both municipal and district councils have borrowing powers, and, under the district councils and corporation subsidy act of 1890, are entitled to grants from the general revenue in lieu of fees formerly received under the auctioneers act of 1862 and the licensed victuallers act of 1880 up to a quarter of the sum collected from general rates not exceeding 1s. in the £ declared during any one year. The city of Adelaide was first incorporated in 1840 under a special ordinance, but the council was abolished in 1843; from that date until 1849 the city was managed as a government department, and from 1849 to 1852 by city commissioners. In 1852 a council was again elected under the provisions of the municipal corporations ordinance of 1849. Since the passing of the municipal corporations act of 1881 Adelaide has been subject to the provisions of the acts relating generally to municipal corporations. The city and other metropolitan municipalities are represented on the fire brigades board of South Australia, and contribute to its expenses.

In 1917 a local government department was established to maintain closer relations between the government and the local bodies, to control the grants-in-aid, to advise on road construction and generally to co-ordinate the road work of the department with that of the local authorities. Usually it has no control over local loans; the minister has power, however, to withhold subsidies payable to local authorities if they fail to carry out any duty imposed by legislation. There is no central control of local officers, except officers of health, whose appointment or dismissal is subject to the approval of the central board of health. All works carried out with financial help from the government are inspected by officers of the central department. The accounts of district councils are subject to the inspection of the auditor-general. By-laws must be approved by the governor. The central department has an advisory rather than a controlling authority.

In 1922 there were 35 corporations and 151 district councils in the State, the corporations covering 59,279 acres with a population of 220,559 and a capital value of £51,100,946, and the district councils 30,196,509 acres with a population of 272,104 and a capital value of £68,293,518. The assessment value of the corporations was £2,544,974 and of the district councils £3,429,776.

Western Australia.—Here three distinct local authorities function: municipal councils, district road boards and local boards of health. The municipal system was established in 1838, when towns were placed under the jurisdiction of non-elective trusts consisting of all resident justices of the peace and landowners. In 1851 Perth was made a city, and in 1871 a municipal institutions act substituted municipal councils for town trusts. Under this act only a few areas were incorporated; it was repealed, except in so far as it affected Perth, by the more comprehensive municipal institutions act of 1895, which was itself repealed by the municipal corporations act of 1906. This act with amendments is now in force. Under its provisions the governor is authorized, upon petition of 50 prospective ratepayers, to incorporate any portion of Western Australia containing rateable property yielding £750 on an annual rate, and to reconstitute municipalities on petition of the council or the ratepayers. The councils consist of a mayor and from six to twelve councillors according to the population of the municipality. Every male adult ratepayer who is a British subject is, with certain exceptions, eligible for election as mayor or councillor; every adult ratepayer who is a British subject, and has paid all rates due for the current financial year, may exercise the local franchise. The term of office is three years; elections take place annually. Plural voting is provided for. All land with certain exceptions is rateable property, rates being assessed on the annual value. Generally the annual value of improved or occupied land is deemed to be the average rent obtainable, less 20 per cent for outgoings; but in no case may the annual value be computed at less than four per cent of the fee-simple value. The annual value of unimproved or unoccupied land is taken to be not less than 7½ per cent of the capital value. General rates may not exceed 1s. 6d. in the £ on the annual value. A special rate may be levied under specified circumstances. The councils have certain borrowing powers, and have a claim to participate in the annual parliamentary grant, provided they have levied a minimum general rate of 1s. in the £ and collected therefrom not less than £300. Newly constituted municipalities, during the first year of their existence, are allowed a subsidy of £2 for every £1 of the produce of the general rate. The city of Perth is subject to the acts governing other municipalities. In 1923 there were 21 municipalities in Western Australia, covering an area of 58,981 acres and with a population of 172,881 and property of a capital value of £31,054,031 and of an annual value of £1,810,173.

Under the road districts act of 1919, which consolidated and amended all previous road acts, the governor is empowered to establish a road district controlled by a road board in any part of the State not included in a municipality. In addition to their special functions relating to

roads and bridges (q.v.) these boards (which consist of from 5 to 13 members elected by adult ratepayers who are British subjects) are invested with most of the powers exercised by the municipal councils. Their revenue is derived from rents, fees, fines, and moneys payable in respect of general, local or loan rates. Rates are levied on the unimproved capital value or, in town-sites, on the annual value. In 1923 there were in the State 121 road districts covering an area of 975,828 square miles.

Until 1886 provisions relating to health and sanitary arrangements were included in the municipal acts; in that year was passed a health act which authorized the appointment of a central board of health, and of local boards in the municipalities, the expenses of the central board being met by the government and of the local boards by a health rate levied by the municipal councils. In 1892 the members of any municipal council were constituted the local board of health; in 1895 the governor was empowered to appoint a local board of health in any area defined by order-in-council, the expenses of which were to be met by the central government; in 1898 all local boards were authorized to levy a special health rate. The consolidating health act of 1911 (which is still in force) substituted a commissioner of public health for the central board, and provided that, where a health district was conterminous with a road district, the road board should be the local board of health. Boards of health may therefore be constituted by municipal councils or road boards, or may be established independently. In 1923 there were 125 local boards of health in the State. Local authorities contribute to the expenses of the fire-brigade service, and are represented on the central board.

Tasmania.—Until 1906 Tasmania was divided into districts of various kinds, each controlled for a specific purpose by a board. These districts had to do with (*a*) main roads, (*b*) roads, (*c*) rabbits, (*d*) fruit, (*e*) public recreation, (*f*) health, (*g*) schools, (*h*) works. There were also rural municipalities and town boards, in addition to the cities of Hobart and Launceston. Under the rural municipalities act of 1858 any town (or any electoral, police, or road district) could be proclaimed by the governor on petition of at least 50 persons concerned who were proprietors or occupiers of property of the annual value of not less than £20. The control of such municipalities as were proclaimed was vested in a council of six members, elected by adult males owning or occupying property of the annual value of £15—provided that, if they were aliens, they held letters of denization. The functions of the council covered the care and management of public roads and streets, the control of the police, water-supply, licensing butchers, registration of dogs and the administration of common-lodging-house and impounding acts. Councils were empowered to levy rates, and received a government subsidy. This act was amended from time to time, but no new principle was introduced. A town boards act passed in 1884 empowered the governor to proclaim towns, but did not apply to any town situated within the boundaries of a rural municipality. Provision was made for the election of town boards, which administered the police act of 1865 with respect to the health and improvement of towns. They were authorized to levy rates. Amending acts vested in them additional powers. All separate districts, together with rural municipalities and town boards, were abolished by the local government act of 1906, under the provisions of which a commission was appointed to divide the State into not more than 60 districts, and to subdivide each district into not less than three nor more than five wards. The cities of Hobart and Launceston were exempted from the provisions of the act. Forty-nine districts were established at the time, but the number has not remained constant. Under the act and its amendments the governor is empowered to incorporate municipalities, to alter boundaries, etc. In each municipality the number of councillors is three for each ward; the warden is elected by the councillors from among their number. Every male elector of a municipality who is resident or has a place of business therein is, generally speaking, eligible for election as councillor; the local franchise may be exercised by any adult ratepayer who is a natural-born or naturalized subject, and by any corporation or joint-stock company the name of which appears on the assessment roll. Plural voting is provided for. A council may define a local district, and assign to it a special standing committee with power to exercise functions vested in it by the council. Every council is empowered to exercise within the limits of its jurisdiction all the powers conferred upon (*a*) the council of a rural municipality by the rural municipalities act of 1865, the rabbit destruction amendment act of 1893 and the police act of 1905; (*b*) the trustees of a road district and a main road district board by the roads act of 1884; (*c*) a board of a town by the town boards act of 1896; (*d*) a local authority by the public health act of 1903; (*e*) a fruit board by the codlin moth act of 1888; (*f*) the trustees of a public recreation ground by the public recreation grounds act of 1888; (*g*) the trustees of a public cemetery by the cemeteries act of 1865; (*h*) a council of a rural municipality as the trustee of a water district; (*i*) a board of advice by the education act of 1885; (*j*) the chief of any inspector of sheep under the Californian thistle act of 1883, with extension of such powers to other noxious weeds. Councils may unite by permission of the governor for the construction of certain works, etc. General and special rates are levied on the annual value of all properties with certain exemptions. Councils have, in addition, borrowing powers, and are entitled to government subsidies. The local government act is administered by the minister for lands and works, who is empowered to settle disputes; local by-laws must be approved by the attorney-general; municipal accounts are subject to government audit. The governor-in-council is empowered to regulate elections, to repeal by-laws, to receive and dispose of petitions, etc.

The cities of Hobart and Launceston are not subject to the general provisions of the local government act. By the Hobart Town commissioners act of 1846 Hobart was divided into five wards, each represented by three commissioners elected for two years; municipal councils for both Hobart and Launceston were constituted in 1852. The city of Hobart was incorporated in 1857, and Launceston in the following year. In 1893 all acts relating to the corporation of Hobart were repealed by the Hobart corporation act of that year; those relating to Launceston were repealed by the Launceston corporation act of 1894. The provisions of these acts, with amendments, are still in force.

In 1922 there were 49 municipalities in Tasmania. The municipalities are represented on the local fire brigade boards and contribute towards the expenses, being authorized to levy a special rate for the purpose either on annual or capital value if the municipal fund is insufficient to meet the charge.

In the *Northern Territory* Darwin has been incorporated as a municipality, and a Bagot road district has been created.

Loch, BARON. Henry Brougham Loch (1827-1900), first baron Loch, born on 23 May 1827 and entered in the navy at the age of 13, left it in 1842 and in 1844 was commissioned cornet in the Bengal cavalry. In 1852 he was made adjutant and second-in-command of Skinner's Horse; in 1854 he was sent to Bulgaria and the Crimea (with the local rank of major) to organize irregular Turkish cavalry; from 1857 to 1860 he was attached to Lord Elgin's missions to China and Japan, in 1858 taking to England the treaty of Yeddo, and in 1860 that of Tientsin, after having been treacherously captured by the Chinese and exhibited in a cage along with the correspondent of *The Times*. After a couple of years spent as private secretary to the then home secretary, he was in 1863 made lieutenant-governor of the Isle of Man; in 1882 became commissioner of woods and forests; and in 1884, the Marquess of Lorne being unable to accept the position, was made governor of Victoria, reaching Melbourne on 15 July of that year. His term of office practically coincided with the prosperous years of the Gillies (q.v.) regime, and his lavish hospitality and encouragement of philanthropic and educational movements soon made him exceptionally popular. In March 1889 he took leave of absence to visit England, and during his stay there was persuaded by the British government to undertake the administration of South African affairs as high commissioner for South Africa and governor of the Cape Colony. He therefore returned to Melbourne for a month only (18 October to 16 November 1889), and proceeded thence to Cape Town, where he remained till 1895. Retiring in that year with a barony, he lived privately in England till his death on 20 June 1900. (C.B., 1861; K.C.B., 1880; G.C.M.G., 1887; G.C.B., 1892; P.C. and baron, 1895.).

Lockyer, EDMUND (1784-1860), born at Plymouth on 21 January 1784, in 1803 entered the army (ensign, 1803; lieutenant, 1804; captain, 1805; major, 1819). With the 19th regiment he served in India and Ceylon, but in 1824 exchanged into the 57th regiment, while quartered in Ireland, and in 1825 sailed from Portsmouth in the *Royal Charlotte* with a detachment of that regiment, reaching Port Jackson on 28 April. Under instructions from Sir Thomas Brisbane, he left Sydney on 1 September in the cutter *Mermaid* to explore the Brisbane River; although it was in flood, he navigated it for a distance of 121 miles, and returned to Sydney on 16 October. He reported very favourably on the area he had traversed, and mentioned the discovery of a coal-seam, specimens from which he brought back for examination. In 1826 the British government, fearing the formation of a French settlement on the western coast of Australia, directed that an expedition should be despatched from Sydney without delay to occupy some station on that coast. Under instructions from Darling, Lockyer in November 1826 sailed in the brig *Amity*, with a detachment of the 39th regiment and a party of convicts, to establish at King George's Sound a settlement of which he was appointed commandant. Darling's instructions to him were detailed and important; if he found the French already in possession, he was to tell them that 'the whole of New Holland is subject to His Britannic Majesty's Government' but, if he reached the Sound first, and French explorers came later, he was merely 'to avoid any expression of doubt of the whole of New Holland being considered within this Government, any division of it, which may be supposed to exist under the designation of New South Wales, being merely ideal.' Lockyer left Sydney on 9 November, put in at Port Dalrymple on the 20th, reached Hobart east-about on 1 December, and anchored in Princess Royal Harbour—the inner basin of King George's Sound—on the 25th. He succeeded in establishing friendly relations with the aborigines (after a brief trouble resulting from their previous brutal treatment by visiting sealers), founded a village on the site afterwards known as Albany, and formally annexed the territory on 21 January 1827. Having fulfilled his mission, he returned to Sydney on 3 April in H.M.S. *Success* with Captain James Stirling (q.v.). In 1827 he explored the Grose valley in the Blue Mountains, but failed to penetrate it. In September 1827, deciding to settle permanently in Australia, he sold his commission and retired from the army, and in November was appointed police magistrate at Parramatta. On 6 June 1828 Darling made him principal surveyor of roads and bridges, but, the colonial office having decided to abolish this office, on 1 January 1830 he handed over his department to the surveyor-general, T. L. Mitchell. In 1827 he had settled at Ermington near Parramatta, and in 1828 acquired by grant and purchase (the grant being a reward for his work in Western Australia) a property near Goulburn which he called Lockyersleigh. In 1847 he took a prominent part at Goulburn in the anti-transportation movement. In January 1851 he attempted to develop an iron deposit near Goulburn which also gave indications of copper, but had no success; over 30 years later the wall of the shaft he sunk was found to contain gold, but not in payable quantities. In 1852 he was appointed sergeant-at-arms to the legislative council, and in 1856 usher of the black rod to the new council. He died on 10 June 1860.—A son, NICHOLAS COLSTON LOCKYER, born at Sydney on 6 October 1855, became Commonwealth comptroller-general of customs in 1910, was a member of the inter-State commission in 1913-20, served as honorary comptroller of A.I.F. canteens during the war, with the honorary rank of major on the retired list, and in 1917 acted as first comptroller of repatriation for seven months, retiring when he had organized the department. In 1921 he was made chairman of the A.I.F. canteens funds trust, which administers the McCaughey bequest for the education of soldiers' children. (I.S.O., 1906; C.B.E., 1916.)

Locusts. See GRASSHOPPERS AND LOCUSTS and CICADAS.

Loftus, LORD. Augustus William Frederick Spencer (1817-1904), fourth son of the second marquess of Ely, was born at Clifton near Bristol on 4 October 1817, privately educated, and trained by his father for the

diplomatic service; his first appointment—to the British legation at Berlin—was dated on the first day of Queen Victoria's reign. His career in diplomacy, which was exceptionally brilliant and important, concerns Imperial rather than Australian history; he was a member of a special mission to various German courts during the revolution of 1848, and served in Prussia during the Crimean war, at Vienna during the Franco-Austrian war, again at Berlin during the Schleswig-Holstein crisis, and—as ambassador—during the Austro-Prussian and Franco-German wars, while from 1871 to 1879 he was ambassador at St. Petersburg. Desiring easier work in a warmer climate, he was at his own request in 1879 made governor of New South Wales, holding the post from 4 August 1879 to 9 November 1885. His term of office included several events of importance to Australia—the completion of direct railway communication between Sydney and Melbourne in 1883, the conferences preliminary to federation of 1881 and 1883, the Sydney International Exhibition of 1879, the visit of Princes Albert and George in 1881, and the despatch of troops to the Sudan in 1885 (see SUDAN CONTINGENT); but only in connection with the last-mentioned event is it asserted that he exercised any personal influence, and the claim that he first suggested the sending of these troops is disputed by adherents of W. B. Dalley and Sir E. Strickland. Returning to England in 1885, he busied himself with the compilation of diplomatic memoirs extending to 1879, and died at Ascot on 7 March 1904. (G.C.B., 1866.)

Logan, PATRICK, entering the army early in life, served in the Peninsular war and was present at six general engagements. On 3 April 1823 he was commissioned captain in the 57th regiment, and in the following year proceeded with it to New South Wales, reaching Sydney in 1825. On 6 March 1826 he was detached with his company to take charge of the new settlement at Moreton Bay, where (although he was not actually the first commandant) he erected most of the necessary buildings—and did the work so thoroughly that until comparatively recent times many of them were in occupation, the old treasury being his military barracks, the observatory his windmill, and the lower floor of the State stores in William-street his commissariat store. As commandant (from the end of 1826 onwards) of a penal station specially formed for the reception of criminals convicted and sentenced in New South Wales—which must, therefore, be a place of real punishment for the worst offenders—his rule was necessarily strict. While actively ruling his small domain, he found time for many journeys of exploration, discovering in October 1826 the river which Darling named after him, and in 1827 investigating by himself (and in 1828 with Allan Cunningham) the south-western ranges of the Brisbane watershed and on 3 August 1828 climbing Mount Lindesay—as it should properly be spelt—for the first time. (This hill is now known as Mount Barney.) In 1830 his regiment was due for relief, and Logan prepared to hand over the post, but desired first to complete a detailed and accurate map of the district. On 9 October he set out to survey an area on the upper Brisbane; on the 11th, when near the Pine ranges, his party met unfriendly blacks, but drove them off; on the 17th, his survey being practically finished, Logan rode away by himself towards Mount Irwin (now known as Mount Beppo) to follow the tracks of a lost horse, and did not return. Four days later the body was found in a shallow grave, the head beaten in with waddies. The reason for the murder was never discovered; but the rumour, set about in the first place by unruly convicts, that other convicts had persuaded the blacks to avenge their wrongs, may be entirely disregarded, and would not be mentioned here had it not been repeated in books published many years later. His body was taken to Sydney, where it received a public funeral.

Log-runner, a genus (*Orthonyx*) of terrestrial birds, frequenting the scrubs of eastern Australia and New Guinea. These birds, of which there are three species, are among the most anomalous of the Australian region, and their relationship to other perching birds is quite uncertain. They were originally placed among the creepers (Certhiidae), and two New Zealand birds known as 'canaries' were also included in the genus. More recently they have been placed in the so-called family Timaliidae, an artificial collection of birds which did not belong to any other recognized family. It seems best to create for them a special family, Orthonycidae, as has recently been done by G. M. Mathews.

The Spine-tailed Log-runner (*O. temmincki*) is an inhabitant of the scrubs of southern Queensland and New South Wales. It is mottled with brown and black above, with yellowish-

Spine-tailed Log-runner.

white on the breast; the male has the throat white, in the female it is pale chestnut. The tail is rather long, and the shaft of each tail-feather is continued as a spine beyond the barbs. The legs and toes are very long and stout for the size of the bird—which is not much larger than the 'willy wagtail;' it uses them for scratching away leaves and sticks beneath which it finds its food. The name 'log-runner' is not specially appropriate, as the birds keep entirely to the ground, and move by hopping rather than running. The curious form of the tail seems to have no relation to the birds' habits. In other birds with similarly modified tail-feathers the tail is used to support them when climbing trees (woodpeckers) or clinging to cliffs (spine-tailed swifts).

The Black-headed Log-runner (*O. spaldingi*) is a decidedly larger bird, about the size of a thrush, with dark brownish-black plumage above and white below; as in the other species, the throat is white in the male, chestnut in the female. As far as is known, this species is confined to the scrubs near Cairns in northern Queensland. In habits it resembles its smaller relative, but is said to be a noisier bird.

The New Guinea Log-runner (*O. novaeguineae*) is closely similar to the southern Australian form, not as might have been expected, to the northern one.

Log-runners construct large domed nests of moss, with a lateral entrance near the bottom,

placed usually on the ground or on the top of a low stump. The eggs are pure white, and very large for the size of the birds; the spine-tailed log-runner lays two, the black-headed species only one.

W. B. A.

Lomatia, a genus of the family Proteaceae, consisting of shrubs or trees with white or pale yellow flowers arranged in pairs. It is represented in extra-tropical South America, but the species indigenous to Australia are endemic. The corolla has an oblique tube open along the lower side and tapering at the top, the segmented lobes cohering for some time; fruit a leathery follicle opening on one side, the valves spreading until the open pod is almost flat; seeds imbricately folded in the fruit, and produced into a broad terminal wing; leaves alternate, entire, toothed, or deeply divided. *L. longifolia* (Mountain Beech), has a hard, light-coloured ornamental wood, used for turnery; *L. ilicifolia* (Native Holly) is an ornamental shrub with holly-like leaves; *L. silaifolia* has finely dissected leaves simulating a fern-frond.

Longbottom, WILLIAM (1799-1849), born at Bingley in Yorkshire on 10 December 1799 and educated locally, was in 1827 admitted to the Methodist ministry and sent by the London Missionary Society to India, where he worked arduously for nine years. In 1836 it was decided to transfer him to Cape Town for the sake of his health, but after a short stay there he went back to India. In 1837 he was ordered to Western Australia, having to travel thither via the Mauritius and Tasmania; and, leaving Hobart in the *Fanny* on 9 June 1838, was wrecked on the 21st on the Coorong beach in South Australia (east of the Murray mouth), rescued after severe trials by the *Lady Wellington,* and brought to Adelaide on 17 August. The small Methodist community there (which lacked a minister) received him with enthusiasm, and he determined to stay among them; but his health soon gave way again, and he was appointed to New Norfolk in Tasmania. Here he stayed till 1843, when he was removed to Sydney; but, hearing that the Church's affairs in South Australia were in confusion, he volunteered to return, reached Adelaide in April 1844, and in spite of bad health worked there for two years more. In 1846 his health failed altogether, and he was forced to resign, members of other Churches as well as of his own contributing a comfortable pension. He died in Adelaide on 29 July 1849.

Long-snouted Honey-mouse, a small mouse-like marsupial (*Tarsipes spenserae*) belonging to the opossum family (q.v.) but with some special features of its own. The head and body are only three inches long, the tail four inches. The short coarse fur is grey above, striped with black or brown, yellowish-white below. The head is long and narrow, with an elongated muzzle. All the claws are rudimentary, except those on the second and third toes of the hind-foot, which are very closely united (syndactylous). The elongated, thinly-haired tail is prehensile. The long-snouted honey-mouse is confined to south-western Australia, where it appears to be fairly numerous in certain districts; it is nocturnal and arboreal, and its chief food consists of honey (which it extracts from flowers by means of a long, narrow tongue) and soft-bodied insects.

W.A.H.

Longstaff, JOHN, born at Clunes in Victoria in 1862, in 1883 joined the art school conducted by G. F. Folingsby in connection with the Victorian National Gallery, and in 1887 won the first travelling scholarship awarded by the trustees of the gallery with a notable picture, 'Breaking the News.' By sheer coincidence the exhibition of this picture followed closely on a mining disaster at Creswick, and many people believed—indeed, it is still believed widely—that it was a deliberate portrayal of an actual incident. The scholarship took Longstaff to Paris, where he studied under Fernand Cormon and gained a *mention honorable* at the Old Salon in 1891 for his 'Young Mother.' In 1893 he made successes at the Royal Academy with 'The Sirens' (now in the Melbourne gallery) and at the Old Salon with 'A Portrait Study'—usually known as 'The Woman in Black'—now in the Sydney gallery. Since that time he has devoted himself mainly to portraiture, being represented at Sydney by portraits of (among others) Henry Lawson (1900), King Edward and Queen Alexandra (1904), and General Monash (1918); in the Melbourne gallery, curiously enough, he is chiefly represented by historical work—'Bush Fires in Gippsland' (1898) and 'The Death of Burke and Wills' (1901), both specially commissioned.

W. M.

Long Toms (also known as needle-fish), members of the family Belonidae, in England and America called garfish—in Australia that name has been wrongly but irrevocably applied to the half-beaks of the family Hemirhamphidae. The Belonidae have the upper and lower jaws equally produced, and armed with rows of needle-like teeth. More than a dozen species occur on the temperate and tropical coasts of Australia, and all are excellent food-fishes. They have green-coloured bones—a peculiarity which has led to the erroneous belief that they are unwholesome as food. Long Toms have the habit of leaping from the water, either when pursuing their prey or in escaping from their enemies. They are voracious fishes, and occasionally attain a length of six feet.

A.R.McC.

Lonsdale, WILLIAM (1800-1864) was commissioned 1st lieutenant in the 4th (King's Own) regiment on 4 March 1824 (captain, 1834), and reached New South Wales on 14 December 1831 with a detachment of his regiment in the *Bussorah Merchant.* After serving in Tasmania (1831), at Cox's River (1832), and at Port Macquarie (1834) he was stationed at Parramatta until September 1836. On the 9th of that month he was appointed police magistrate of the new settlement at Port Phillip and commandant of the troops stationed there, with general superintendence of all such matters as required the immediate exercise of the authority of the government. He reached Port Phillip in the *Rattlesnake* on 29 September, a staff of surveyors with apparatus and provisions following soon afterwards. Lonsdale's salary at the time was £250 per annum, increased to £300 when in March 1837 he resigned from the army. At first he was handicapped by lack of accommodation, and was obliged to reside on board the *Rattlesnake* until 30 November, while a four-roomed cottage was erected. His first business was to determine the official site of the new settlement—then popularly known as Bearbrass. He decided to abide by the existing site, since

at the rival site (Point Gellibrand, now Williamstown) the water-supply was very deficient.

Following the precedents of Sydney and Hobart, he proposed to name the town Glenelg, after the secretary of state for the colonies; but Bourke (who confirmed the choice of site, but did not like it) gave the King's name to the site he personally preferred—Williamstown—and that of the prime minister to Melbourne. The first census of the district was taken in November 1836, when 364 residents were enumerated. Immigrants continued to arrive, and Lonsdale was soon confronted by the difficulty of placing newcomers in suitable employment. The erection of requisite public works and the survey of the district were proceeded with, but the work of survey was hampered by unfriendly relations between Lonsdale and the surveyors—Hoddle, indeed, refused to acknowledge Lonsdale's authority outside his sphere as police magistrate. To deal with the aborigines Lonsdale took into government employ William Buckley (q.v.), but he proved unsatisfactory as an official and retired after a year's service. After an unsuccessful attempt to establish a Church of England mission house under the care of George Langhorne, a department for the protection of aborigines was established under instructions from the colonial office, and in 1839 George Robinson (q.v.) was invited to become first protector. Meanwhile Bourke had advised the colonial office that more adequate provision should be made for the administration of the distant settlements at Melbourne and Geelong, and suggested that a lieutenant-governor or superintendent be appointed, with civil and military authority over all the southern districts of New South Wales, subject to the authority of the governor in Sydney. Charles Joseph Latrobe (q.v.) was therefore made superintendent of the Port Phillip district, and reached Melbourne on 30 September 1839. Lonsdale retained his position as police magistrate for eight months, and was then appointed sub-treasurer of the new administration. He was subsequently appointed interim mayor of Melbourne in 1842, acting-superintendent in 1846-7 (during Latrobe's absence in Tasmania), and colonial secretary of the new colony after separation. This position he resigned in 1853, and returned to England, where he died on 28 March 1864.

Loquat. See FRUIT-GROWING.

Loranthaceae, a family of much-branched shrubs, parasitical on the branches of trees and shrubs—except *Nuytsia* (q.v.) and *Atkinsonia* (q.v.)—abundant within or near the tropics, but less common in temperate regions. Of the five genera indigenous to Australia three (*Nuytsia, Atkinsonia, Notothixos*) are endemic. The petals or perianth segments are 4-6, free or united; fruit a berry or drupe with a single seed. The parasitic species sometimes simulate the shape and colour of the foliage of their host. See ATKINSONIA, LORANTHUS, NOTOTHIXOS, NUYTSIA, VISCUM.

Loranthus, a large genus of the family Loranthaceae, consisting of parasitic shrubs, chiefly tropical and subtropical. They are usually known as 'mistletoes,' their habit of growth resembling that of their near relative the English mistletoe (*Viscum*). Australia has 26 species, the majority endemic. The flowers are elongate, from bright red to dull green; petals 4-8, free, or more or less united into a tubular corolla; fruit a berry; leaves usually opposite. Some loranths are parasitic upon their own kind, as well as upon other trees. Birds eat the succulent berries, and distribute the seeds in their droppings.

Lord, EDWARD (1780-1859), joined the royal marines as second lieutenant on 12 September 1798 (1st lieutenant, 1804), and reached Australia with the detachment that accompanied Collins to Port Phillip in 1803. When, early in 1804, Collins moved to the Derwent, the senior marine officer was left behind, and Lord found himself in charge of the guard at Hobart. There he built the first house, near the corner of Harrington and Macquarie streets, a site so far from the camp that it was known as 'the house in the bush.' In 1805 he applied for leave to return to England; but Collins sent him to Sydney for King's approval, and King, finding him interested in live stock, after six months sent him back to Tasmania with a number of ewes and 'a ram as near the Spanish breed as Government is in possession of.' In 1806 his flock of 100 sheep was the largest privately owned in Tasmania, but by 1809 two other breeders had passed him. In 1807 he became senior officer next to Collins himself, and when Collins died suddenly on 24 March 1810 took over charge of the colony; but Macquarie, preferring to have in Tasmania a deputy he knew he could depend on, hastily sent over John Murray, a captain of his own regiment, told Lord he could go back to England as soon as he liked, and rather peremptorily relieved him of all his offices. Early in 1811, therefore, Lord left Tasmania on 12 months' leave, and at the expiration of it retired from the marines and returned to Hobart as a private settler and merchant. In this capacity he repeatedly fell foul of the authorities: Macquarie listed him for Sorell's benefit as a dangerous and troublesome person, and described him to Bathurst as vindictive and implacable. Brisbane talked about his 'sordid interests,' and proposed to remove him from the magistracy. On the other hand Sorell considered his conduct 'unexceptionable' and in 1818 made him a member of the lieutenant-governor's court, and Bathurst, meeting him while on a visit to England in 1820, specially commended him to Sorell's attention—a recommendation which procured his appointment in 1821 to the magistracy. He was then the largest proprietor in the settlement, and in 1823 was one of the original proprietors of the Bank of Van Diemen's Land. By that time, however, he was residing in England, where he lived for the rest of his life, dying in London on 15 September 1859.

Lord, SIMEON (1771-1840), was in 1791 transported to New South Wales (his offence is not known for certain, but Davey in 1817 declared it was picking pockets and Bigge called it 'insignificant'), and reached Port Jackson in the *Atlantic* on 20 August. He was at first assigned as servant to an officer of the New South Wales Corps, but developed a business ability that soon made him his own master. By 1798 he was acting as agent for certain ship-captains, and in 1800 was one of a syndicate that persuaded Hunter to let them purchase goods direct from incoming vessels, and so broke up the Corps' monopoly of trading; the same year he and Hugh Meehan bought a prize ship, and in 1801 began trading on their own account. By 1803 he was a licensed auctioneer, and in 1804 was registered as a shipowner dealing in wool, oil, and sheepskins. By 1806 he must have been rich, for at least one debtor owed him

£2300 and was given easy terms; but in the same year he fell foul of Governor King, who suspected him of illicit trade with the French, then our enemies. In 1807 he quarrelled with Governor Bligh over the method of trans-shipping some cargo, was sentenced without trial to a month's imprisonment, and became Bligh's bitter enemy (Bligh was censured by the colonial office for this injustice); he was one of the six who signed the pre-mutiny requisition to Johnston (the requisition still extant was possibly drawn up, and certainly signed by most of the petitioners, after Bligh's arrest), and for a time was high in favour with the mutineers. But Lord, like the Blaxlands (with whom he at this time went into partnership), was primarily a business man, and only interested in politics so far as it affected his trade. Johnston was at loggerheads with him by April 1808, and Macarthur (for once agreeing with Bligh) accused him of acquiring a fortune by infamous means. Foveaux, however, took him back into favour, made him government auctioneer, and gave him the freehold of the block in Macquarie Place, Sydney, on which he had built the well-known house that maintained his memory until early in the present century. Macquarie favoured him greatly, made him a magistrate on 17 May 1810, and encouraged him to frequent government house as a guest.

Lord had by now launched out into useful speculations of several kinds. He became prominent in the whaling and sealing industry, and promoted attempts to import and manufacture New Zealand flax; the unfortunate *Boyd*, whose crew was massacred by the Maoris in 1809, was chartered to him, and in 1815 he was again asking Macquarie for leave to form the 'New South Wales New Zealand Company.' In 1808 he was interested in pearl fisheries; in 1812 he applied for permission to mine iron ore at Port Dalrymple in Tasmania; in 1813 he was trading in sandalwood; in 1819 he backed Thomas Kent (q.v.) in experiments for extracting tannin from wattles and soda from Tasmanian seaweeds. In 1815 we find three Bengali workmen in his employ, but their special duties are not indicated. But during the intervening years the feeling of the free settlers against Macquarie's intimacy with emancipists had grown bitter. Marsden refused to sit on the bench with Lord, but other free magistrates would not go so far. Ellis Bent was sarcastic about his business integrity, and Barron Field (with whom he was associated in 1817 as a member of the supreme court) thought him not 'sufficiently literate,' too much biassed in favour of emancipists, and likely to 'take every advantage as a Tradesman.' The latter charge was probably a result of local prejudice, for Bigge notes that his trustworthiness as an agent commended him to 'those who were strangers to the colony.' In 1819, however, his lack of experience and breeding produced awkward scenes in court of which Bigge and others took advantage to put pressure on Macquarie, and at the governor's instigation Lord in 1821 resigned his justiceship and devoted himself for the rest of his life to business. It is said that he was the first man to manufacture home-grown wool in his mills at Botany; these, as well as his hat factory, were in existence before 1819. One instance of his excellent business instinct may be noted. Foveaux had, as mentioned above, given him the freehold of land in and near Macquarie Place, and Macquarie had resumed about half an acre of it to create the park that still exists there, but had not definitely allotted him compensation; Lord after many years' persistence persuaded Governor Darling to settle the matter, and in 1828 obtained nearly 18,000 acres of land on the Hunter and beyond the Blue Mountains in exchange for the half-acre. In later life he went to live near his Botany mills, and there he died on 29 January 1840. His family must not be confused with that of Edward Lord, lieutenant of marines, who in 1810 administered for a few months the government of Tasmania.

Simeon's son GEORGE WILLIAM LORD sat in the first and second New South Wales legislative assemblies as member for Wellington and Bligh (1856-9), and from 1859 to 1877 represented the Bogan; he was treasurer in the Martin ministry of 1870-2. From 29 October 1877 to his death on 10 May 1880 he was a member of the legislative council. Another son, FRANCIS, represented Bathurst in the legislative council from 1843 to 1848, and sat in the nominee council from 1856 to 1861 and from 1864 till his death in 1892.

Lord Howe Island is situated in 31° 33′ S. lat., 159° 5′ E. long., 300 miles due E. of Port Macquarie and 450 miles NE. of Sydney. The nearest land eastward is Norfolk Island (500 miles) and south-eastward New Zealand (750 miles). Nearly seven miles long by an average width of one, the main island has an area of 3220 acres, of which from a quarter to one-third have been estimated as capable of cultivation. Detached islets are Gower Island at its southern end, the Sugar-loaf to the north, Mutton-bird Island about half a mile to the east, and Goat or Rabbit Island within the western lagoon. A quarter of a mile northward lie six rocks known as the Admiralty Islets; North Island and its companion rock lie beyond these. Ten miles SE. rises the almost inaccessible Ball's Pyramid (named after the discoverer of Lord Howe Island), which rears its 1816 feet sheer from the ocean with a base only 60 by 25 chains. The largest of the Admiralty Islets is nearly half a mile long, probably 300 feet high, and, like the main island, precipitous on its eastern face. A landing here, as on Mutton-bird Island, can only be effected in the calmest weather.

History.—The island was discovered by Lieutenant Henry Lidgbird Ball, commander of H.M. tender *Supply*, on 17 February 1788, during a passage from Port Jackson to Norfolk Island. Ball examined the island on his way back to Port Jackson, and reported that it abounded in turtle. On 6 May, therefore, Phillip sent him back for a supply, as fresh meat was scarce in the settlement; but he had to report that no turtle could be found, nor any sign of their breeding there, and that the water-supply was poor. In January 1790 he tried again, and after much hunting secured three turtles, but found that there was no good anchorage. Consequently the island was for many years neglected. Whalers occasionally put in, and some introduced pigs, goats and, unfortunately, cats, which almost destroyed several rare birds—among them a woodhen (*Ocydromus sylvestris*), a sort of guinea-fowl and a ground-pigeon. *Notornis alba*, another gallinule, was extirpated by the crews of whalers, who found it as edible as it was friendly.

In 1834 three white men from New Zealand—Ashdown, Bishop, and Chapman—accompanied by three Maori girls and two Maori boys, landed

from the whaling bark *Caroline* and formed the first settlement. They were bought out by a Sydney ironmonger named Dawson and his partner Poole for £350; Dr. Foulis came in as a third partner. The original settlers then returned to New Zealand, and in 1843 Wright, McAuliffe, and Hesketh, with their wives, went to the island in Dawson's little vessel the *Rover's Bride*, followed by Margaret Andrews and her husband and A. P. Mosely; but Dawson found his venture unprofitable, and abandoned it, only those remaining on the island who chose to do so independently. The patriarchal method of Poole's government is shown by his treatment in 1843 of a new arrival, who would not work, by chaining him to a tree, confining him in stocks, and finally taking him to Sydney in a cask. In 1851 Dr. Foulis furnished the government with a report stating that about 16 persons were resident, and that from 60 to 80 whalers put in for wood, water and provisions; the residents kept poultry, pigs and goats, and cultivated maize, potatoes and onions—the last being especially prolific and good for export. In 1869 there were 35 residents on the island, and in 1875 it was proclaimed a reserve. The census of 1921 showed the population as 121. The chief industry is the gathering and export of *Howea* (better known as *Kentia*) palm seed. Lord Howe Island lies east of the 154th degree of longitude, which is the eastern limit of jurisdiction of the government of New South Wales; consequently in the constitution acts and in proclamations applying to the whole State, it has to be specifically included by name.

In July 1912 a royal commission appointed to enquire into the palm-seed trade issued a report that resulted in the formation of a board of control, sitting in Sydney, for island affairs, with a local advisory council on the island itself. Under the board the residents are mostly shareholders in a company controlled by the government. A resident born on the island acquires so many shares upon attaining his majority. No land is privately owned, and the residents pay no rent. The island is included in the King division of the Sydney electorate.

Neither implements, nor rock carvings, nor any other traces of an aboriginal population have been discovered.

A survey of the island was made in 1835 by H. F. White, whose map was apparently first published by Hill in 1878. Many of the original names of prominent features—presumably given by White—have since been altered. A good map was issued with the *Report on Lord Howe Island* made by J. Bowie Wilson in 1882. The island is crescent-shaped, and consists of three volcanic ridges, connected by lower undulating land formed by wind-blown coral sand. Of these ridges by far the greatest—forming, roughly, half the total land area—is the southern massif, with its two giants Mount Gower (2840 feet) and Mount Lidgbird (2504 feet) and the lesser hills North Hummock and Intermediate Hill (647 feet). The first two are separated by the deep Erskine valley. Intermediate Hill sends out an eastern spur towards Mutton-bird Island, with which it was probably connected in recent geological periods. The northern ridge consists of semi-detached peaks, with a bold sea-face of precipitous cliffs 600 to 700 feet high. The chief feature of this is Mount Eliza, an isolated peak—'cut vertically in half, concave towards the sea' says Etheridge; northeast of this lies North Peak, or Poole's Lookout. The third (the intermediate) ridge is formed by a conical hill, Mount Look-out (414 feet), with its seaward extension, known locally as Clear Point, but marked on the admiralty chart as Observatory Point. On the eastern side three sandy beaches occur, known as Ned's Beach, Middle Beach, and Blenkinthorpe Bay; the second contains the best landing-place, immediately north of Clear Point. A short, narrow inlet near Mount Eliza is known as the Gulch. A fringing coral reef forms the chord of the island crescent, extending from Phillip Point to the base of Mount Lidgbird, and within it lies the lagoon—about four miles long by an average breadth of half a mile—having narrow entrances through the reef, and washing a beautiful stretch of sandy beach 1¼ miles long at the middle of the island. Hedley has remarked that Lord Howe is the farthest south of islands having coral reefs. The chief freshwater creeks are Deep Creek, which with its branch Soldier's Creek drains the western flanks of Intermediate Hill and Mount Lidgbird; Freshwater Pool, a rocky gorge of the latter mountain; the Valley of the Shadow of Death near Middle Beach, and a short water-course that drains the eastern part of the northern ridge. Abundant showers, chiefly from the SE., afford an ample water-supply, and nourish the luxuriant vegetation with which the island is clothed.

The tide rises and falls about six feet. Two good anchorages exist; the NE. roadstead, off Ned's Beach in 16-18 fathoms, and the SW. roadstead, outside the middle entrance to the lagoon in 15-18 fathoms. The prevailing winds in summer are from the SE., in winter from the SW.; the latter are often accompanied by violent rain squalls. E. S. Hill states that occasional cyclones from the NNW. devastate narrow areas, while miniature whirlwinds, termed 'wollies' by the inhabitants, sweep from the deep gullies to the sea. The summer temperature seldom rises above 80° Fahrenheit, and the winter climate is genial, so that the island has been termed 'the Madeira of the Pacific.'

Mount Gower may be ascended by two routes. The longer is a rough track round the eastern spurs of Mount Lidgbird; a more hazardous one, known as the Lower Road, skirts the face of the mountains 500 feet above the sea. This is in places but two feet wide; footholds have been cut on it with a pick, but there is little or nothing but the rough surface of the wall as handhold. Mount Lidgbird is even more difficult of access, and requires energetic climbing with the aid of ropes.

Geology.—Two-thirds of the island is composed of volcanic rocks, sections of which may be seen along the coast and on the precipitous sides of the mountains. Thus 'on the face of the North Ridge' says Etheridge 'a section, 700 feet high, shows a successive alternation of beds of agglomerate and a harder and denser rock, seamed in all directions by dykes and veins, a number of which are quite vertical and run up the face of these magnificent cliffs like so many ladders.' 'These volcanic rocks' writes Sir Edgeworth David, 'appear to belong to three leading types, (1) basalt with olivine, (2) basalt without olivine, lateritic, (3) basalt, diabasic: probably of considerable geological antiquity . . . . A vast period of time must have elapsed between the eruption of (3) and (1). . . . All the basalts, with the exception of the diabasic types, are probably not earlier than Tertiary, and some may be post-Tertiary. The

diabasic basalt is probably pre-Tertiary, and may be Palaeozoic.'

A. R. Wallace noted that a submerged bank extends at a depth of about 1000 feet from New Zealand north-westerly to Lord Howe Island; this is confirmed by the soundings made by the *Challenger* expedition. The connection with New Zealand has further corroboration from zoology. According to Etheridge 'there is reason to believe that Lord Howe Island originally formed part of the New Zealand volcanic area, and certainly dates back to the Pleiocene period, perhaps further;' the coral-sand rock is wind-blown (aeolian) in origin, and tallies well with Dana's description of drift-sand rock (*Corals and Coral Islands*, p. 154); and 'the supposition that Lord Howe, as we now know it, was composed of a few small islets is based on the fact that it would require a depression of but comparatively few feet to return it to this condition. This granted, we have but to imagine a slight upheaval, and circumstances favourable for the accumulation of the coral-sand rock would at once exist.'

Natural History.—The crowning glory of Lord Howe Island is its vegetation, which covers the greater part of its surface with a dense growth of plants—many of them peculiar to the island. In the earlier days the undergrowth was partially cleared by pigs and goats liberated by the first settlers; but domesticated goats have been got rid of by mutual consent of the islanders, the pigs have been penned in, and the wild goats and pigs are now confined to the extremities of the island. Travelling is difficult except along the beaten tracks. The islanders largely employ sleighs, wheeled vehicles being scarce. To quote Allan McCulloch:—'The shady paths winding over the island are wonderfully beautiful, and here and there present glimpses of the lagoon and the mountains which are rare pictures of delicate colour and charm. Sometimes they pass through forests of palms which wall them in on each side with a dense growth in every stage, from the fresh young shoots just appearing above the ground to the tall trees whose leaves form a canopy overhead, filtering the sunlight to gleam on the shining green undergrowth.'

There are four species of these palms. The Thatch Palm (*Howea Forsteriana*), the seed of which forms the chief commercial asset of the island, flourishes on the lower ground and up to 400 feet above sea-level; the Curly Palm (*H. Belmoreana*) extends to 1200 feet above; the Umbrella Palm (*Hedyscepe Canterburiana*) is found from the 1000-ft. contour-line to the summit of the two mountains; the Dwarf Mountain Palm (*Clinostigma Mooreanum*) is confined to the summits of Gower and Lidgbird. The thatch palm is confined to coral-sand rock formation; the others are found only on volcanic soil. The most remarkable tree on the island is the Banyan (*Ficus columnaris*) which, starting life as a parasite in crevices of other trees, sends down trailing stems that after a time strangle the host, and later develop adventitious roots that form rope-like stems. These often coalesce to form trunks, a few dozen of which will cover an area of two or three acres.

In the 1882 report of J. Bowie Wilson the prevalence of a disease amongst these trees was noted, due to a psyllid insect, causing defoliation and death on a wide scale. An even wider devastation of the tree is occurring at the present time; photographs by A. R. McCulloch show many dead banyans, probably due to the depredations of insects following the wholesale destruction of birds by the rat pest. A. M. Lea has observed the presence on this tree of the same chalcid wasp (*Pleistodontes froggatti*) that fertilizes the Moreton Bay fig in New South Wales.

'The top of Mount Gower' wrote the late W. W. Watts, 'is a veritable paradise of plant life. Here on this rich plateau may be found fern after fern and moss after moss that occur nowhere else in the world.' Of tree-ferns the most superb are *Cyathea brevipinna, C. Macarthuri,* and the two indigenous species *Alsophila robusta* and *Hemitelia Moorei.* The magnificent *Asplenium melanochlamys* somewhat resembles a young tree-fern. On the slopes of the mountain occur the beautiful ferns *Dryopteris nephrodioides* and *Blechnum Fullagari* (the latter in profusion) as well as three species of *Hymenophyllum*; *H. pumilum* and *H. multifidum* grow in the utmost luxuriance, together with *Trichomanes Bauerianum.* Here also is to be found the rare, large-fronded *Leptopteris Moorei, Polystichum Whiteleggi*—locally known as the 'heavy fern'—and *Polypodium pulchellum,* remarkable for its clothing of reddish-brown hairs. Other parts of the island have ferns of wider distribution, such as *Adiantum aethiopicum, A. hispidulum, Platycerium alcicorne, Marattia fraxinea* (known to the islanders as the horseshoe fern) and *Ophioglossum vulgatum.*

In 1893 Professor R. Tate recorded from the island 207 species of plants belonging to 154 genera; 56 of these species were endemic. His general conclusion is that 'the affinity of the species is certainly greater with Australia than with any other region of the Australasian Province. But, as the flora presents certain marked affinities with that of New Zealand, and keeping in mind the large community of species between Norfolk Island and Lord Howe Island, and the fairly well-marked affinity generically with Norfolk Island and New Zealand, there is no choice but to regard Lord Howe Island as a companion outlier to Norfolk Island of the New Zealand region' (*Macleay Memorial Volume,* p. 214). The affinity, he adds, of the land faunas, particularly in the classes of birds and gastropods, is rather with Polynesia and New Zealand than with Australia.

Zoology.—One of the strongest arguments in support of the relation of the fauna to that of New Zealand is the absence of an indigenous mammalian fauna. The only indigenous lower mammal known is a scarce bat (*Scotophilus morio*). On the other hand certain introduced mammals have rapidly increased. Hill states that about 1845 'a number of cats were sent ashore from a whaleship. These soon became populous and found an easy prey in the native birds. Their descendants, or those of later domestications, still exist in the hills, where are also found goats and swine—the last confined to the southern end.' Mice (*Mus musculus*) were accidentally introduced about 1868, and in two years swarmed over the island. The latest and worst of these pests is the rat, introduced in 1919 from a stranded vessel. 'In two years,' says McCulloch, 'they have made the note of a bird rare, and the sight of one, save the strong-billed magpie and the kingfisher, even rarer. Within two years this paradise of birds has become a wilderness, and the quiet of death reigns where all was melody. The very few birds remaining are unable to breed, being either destroyed upon their nests or driven from

them by the rats, and their eggs eaten . . . . With the birds gone, injurious insects have increased unchecked, and are destroying the produce of the island gardens. The rats also eat the corn ere it ripens, and extract the pulp from bananas, pomegranates and other fruits . . . . Dire distress threatens the residents unless some unsuspected cause brings about a reduction of the rats.' Introduced rabbits existed for a time on Rabbit Island, but were never established on the main island, and appear to have died out.

Birds.—In 1788 the birds (writes McCulloch) 'having no enemies other than of their own kind, for there were neither mammals nor reptiles to prey upon them, knew not what fear meant, and wandered up to observe what strange intruders had come to disturb their seclusion . . . white birds with scarlet bills (*Notornis alba*), about the size of a hen, being plentiful.' These fearless and flightless birds were, alas! good to eat, and the crews of visiting whalers slaughtered them wholesale, while the introduced cats and pigs completed the annihilation. No material record remains of this unique species, save a skin in the Vienna museum and a specimen in the Liverpool museum.

Woodhens (*Ocydromus sylvestris*), that once roamed plentifully over the whole island, are now confined to the upper parts of the mountains. 'A bird whose curiosity overcomes its shyness and comes hurrying out of the forest to investigate the cause of such noises as the tapping of two stones together or the notes of a mouth-organ—approached sufficiently close to be snared with a palm-leaf noose,' says McCulloch. The beautiful little green pigeon (*Chalcophaps chrysochlora*) was in 1907 very plentiful, and so tame that it could easily be snared by a noose at the end of a stick. Hull records 22 species of birds, belonging to 20 genera, as breeding on the island. As with the flora, 'the character of the avifauna is more distinctly Australian than New Zealand; although the woodhen (*Ocydromus*) and the extinct *Notornis alba* and *Nestor productus* may be regarded as of greater value in determining the original route of emigration.' The Mutton-bird of Tasmania (*Puffinus tenuirostris*) breeds in large numbers on the island, and emits at night weird moanings and wailings during the breeding period, while digging burrows in the sandy soil. The Little Mutton-bird (*P. chlororhynchus*) breeds on the smaller islets. The Sooty Tern (*Sterna fuliginosa*), locally known as 'wide-awake,' provides the inhabitants with an abundance of fresh eggs from September to November. Three small lizards occur on the island, of which the commonest (*Phyllodactylus guentheri*) exists also on Norfolk Island and in north-western Australia. In the paucity of its reptiles Lord Howe resembles the Sandwich Islands.

Of the 200 species of fishes recorded by Waite none are peculiar to the island; they are chiefly of Australian affinity. But numerous interesting deep-sea fishes, unknown elsewhere, are thrown up on the beaches from some cause that is not apparent.

Of the 118 shells recorded by Etheridge the most interesting are the land shells, which show several species peculiar to the island. Two of these (*Helix sophiae* and *Bulimus bivaricosus*) are found in immense numbers in damp, shady situations. Among the 24 land shells known in 1889 are two freshwater species of *Bythinella*, found in the steep 'runs' of Mount Lidgbird. The land snails, according to Hedley, are all endemic, and among the inoperculate group the auriculoid *Placostylus* claims affinity with New Zealand, and utterly repudiates kinship with Australian life.

Insects.—A. M. Lea notes the affinity of the insects of the island with those of northern New South Wales, but there is an admixture of New Zealand forms. A large number of 'borer' beetles attack the decaying palms and tree-ferns; the characteristic Australian scarabs and buprestids are almost entirely absent. The most interesting of the endemic insects is a wingless phasma (*Karabidion australe*), locally known as the 'tree-lobster;' these insects live in communities in hollow trees, are night-feeders, and betray their dwellings by the heaps—amounting sometimes to bushels—of their droppings. Wingless crickets are also to be seen by night on the banyans. A cicada (*Psaltoda insularis*) is abundant, and has lately attracted the notice of the wide-awake terns, which frighten the insects from the trees and catch them on the wing. A peculiar freshwater crab (*Halicarcinus*) is found on North Ridge. Land planarians of five or six species are numerous. The rock-pools of the coral-reef are prolific hunting-grounds for the naturalist. Branching madrepores and softer bluish *Xenia* corals form refuges for a vast variety of life: anemones with their curious sub-parasitic fish (*Amphiprion*); a rare swimming crab (*Caphyra*), of the exact tint of its coral host, but with a pattern that delineates the surrounding polyps on its carapace; a species of trepang, sea-urchins, clams, starfish and other wonders.

Lord Howe Island must not be confused with Howe Island in the Recherche Archipelago (Western Australia), or with a small group known as Lord Howe Islands, or Ongtong Java, near the Solomon Islands. There are Lord Howe Islets in the Santa Cruz and Society groups.

E. S. Hill's *Official Visit to Lord Howe Island* (1870) epitomizes previous history well. The natural history of the island is dealt with in many papers in the *Records* of the Australian museum, the *Australian Museum Magazine*, and the *Proceedings* of the Linnean Society of New South Wales.

Lorikeet, Lorilet, Lory or Lowry. See PARROTS.

Lotus, a widely-dispersed, chiefly tropical genus of the family Leguminosae; all the species indigenous to Australia are herbs. The flowers are yellow, pink, or white in small clusters, each cluster supported by a leafy bract; leaves with 4-5 leaflets. A variety of *L. australis* (Native Bird's-foot Trefoil, because its three upper leaflets are arranged as in the English clover) at certain periods of its growth contains prussic acid in sufficient quantities to poison stock; some authorities, however, regard it as a useful fodder-plant.

Lotus-bird. See WADERS.

Lowan. See MOUND-BIRDS.

Lowe, NATHANIEL, commissioned lieutenant in the 40th regiment on 29 November 1821, sailed with his regiment for New South Wales early in 1824, and was detached soon after his arrival for service with the mounted police, at first at Bathurst, then at Wallis Plains (now Maitland). In June 1826 he was sent with a detachment of police to apprehend some aboriginals who were alleged to have committed mur-

ders of white men in the upper Hunter district, and was afterwards charged with having (*a*) allowed his men to shoot three natives while in custody, (*b*) ordered the shooting of a native prisoner, Jackey Jackey, who was supposed to have committed a murder. To the first charge his answer was that the natives were shot while attempting to escape, and this seems to have been accepted; the second was taken up by the anti-Darling press and used as a weapon against the governor, whose endeavours to prosecute a full enquiry into the matter were repeatedly thwarted by accidents and by the unwillingness of civilian witnesses to give evidence. After some trouble Lowe was arraigned before the supreme court on 18 May 1827 for the wilful murder of Jackey Jackey. His counsel, W. C. Wentworth and Dr. Wardell, raised the remarkable defence that the court had no jurisdiction over cases involving aboriginals, since they should by the law of nature be punished 'in the very way in which they themselves would punish others falling into their hands.' Judge Forbes overruled this claim, but Lowe was acquitted on the ground that the crown witnesses were not to be believed. He then rejoined his regiment, which had meanwhile been transferred to Tasmania.

Lowe, ROBERT. See SHERBROOKE, LORD.

Lucerne, a leguminous fodder-plant native to southern Europe, and taken thence to the Americas by the Spanish conquistadors, was brought to Australia from Chile in September 1827 by John Powditch, master of the *Elizabeth*. By December of that year it was naturalizing itself in many Sydney gardens. In those days it was known as 'alfalfa' (Arabic for 'the best feed'), and the name is still used for it in the United States. Its adoption as a fodder-plant was slow, and confined until late in the 19th century to the alluvial flats of the Hunter, Cudgegong, and Macquarie rivers; on the Hunter eight cuttings were sometimes obtained in a year, yielding about seven tons per acre of dry lucerne hay. The development of irrigation (which suits lucerne well), and the great dairying activity that followed the introduction of refrigerated exports, instigated for a time a steady extension of lucerne-growing in New South Wales and Queensland—the agricultural regions of the other States lying, for the most part, in too cold a climate.

	Acreage.				
	1891	1901	1911	1921	1923
New South Wales . .	20,014	31,491	70,559	70,995	72,337
Queensland .	—	34,117	61,750	53,059	60,042

These figures do not include lucerne grown as a green crop on which stock may be pastured. In the other States there are small areas of lucerne cultivation, notably on the irrigated fields of the Goulburn and Werribee (Bacchus Marsh) schemes: the total acreage in 1923 for all States except New South Wales and Queensland was not quite 32,000, of which 27,000 were in Victoria.

A common tropical weed, *Sida rhombifolia*, known usually as Queensland Hemp, is in some States also called Native Lucerne or Paddy's Lucerne.

W. S. C.

Lung-fish. See CERATODUS.

Lutwyche, ALFRED JAMES PETER (1810-1880), born in London and educated at Charterhouse and at Queen's College, Oxford (B.A., 1832; M.A., 1835), after spending a few years as a reporter on the *Morning Chronicle* (where he was a colleague of Charles Dickens) was called to the bar in 1840 and practised as a barrister for about 10 years. For reasons of health he then migrated to Australia, was shipwrecked on the way, and reached Sydney on 30 December 1853. On 12 September 1856 he was nominated to the council and made solicitor-general in the first Cowper ministry (1856), resuming that post in the second (1857) Cowper ministry and transferring to the attorney-generalship in November 1858. In February 1859 he resigned office and his seat in the council on appointment as a judge of the supreme court, and in October of that year was made resident judge at Moreton Bay. Two months later Queensland became a separate colony and Lutwyche its only judge; he therefore expected to be given the post of chief justice, but in 1862 the Herbert ministry fetched James Cockle (q.v.) from England to fill the position. Before this, however, Lutwyche had fallen foul of the ministry. As a New South Wales judge he drew £2000 a year; a Queensland act of 1860 gave him only £1200; and the legislative council, when in 1861 on a hint from London it agreed to restore the larger sum, added a condemnation of the judge for political partisanship and impugning the legality of the constitution. An action for seditious libel which resulted from these proceedings—and had to be tried before Lutwyche himself—assumed importance because it involved high constitutional problems; and the British law officers decided (*a*) that the legislature is not a part of the government, and (*b*) that, whether or no that be so, a seditious libel can be published concerning it. With the arrival of Cockle the dispute calmed down, and in 1866 the two judges collaborated in a revision of Queensland's statute law—though Cockle seems to have done most of the work. Judge Lutwyche died on 10 June 1880.

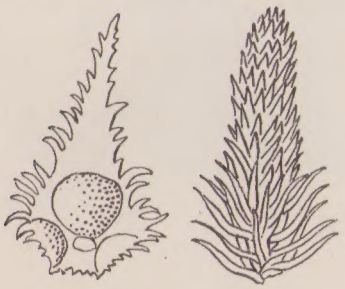
Lycett, JOSEPH (also known as Joseph Lysaght), reached New South Wales in 1810 as a convict, his crime being the uttering of forged notes. He was employed in the police office, but in 1815 was again convicted of forgery and was sent to the Newcastle mines. While there he was allowed to paint an altar-piece for the church then in course of erection, and on the recommendation of the commandant was for this service granted a conditional pardon and allowed to return to Sydney. There he earned his living by painting, and in 1819-21 completed a series of coloured drawings depicting scenes in New South Wales and Tasmania. Three of these—showing a general view of Sydney, the government house at Parramatta, and the government cottage at Windsor—were sent to Earl Bathurst by Macquarie in February 1820. Bigge reported that Lycett's conduct was good, 'but his habits of intoxication were fixed and incurable.' In September 1822 he returned to England—it is supposed that Bathurst paid him for the pictures with a free pardon—and in 1824 brought out in 13 parts a series of *Views in Australia* (advertised as 50 in number, but in reality consisting of 48 views and two maps) with descriptive letterpress; the three given to Bathurst were not among them. The *Views* were republished in 1825 as a single volume. Both the parts and the volume were issued in two states, (*a*) with plates coloured after nature and (*b*) with the plates plain.

Nothing more is certainly known of Lycett, but a MS. note in the Mitchell Library's copy of the *Views* states that he lived for some time in the west of England, forged some notes on

the Stourbridge (Worcestershire) bank, was arrested therefor, and committed suicide rather than stand his trial. See ART.

Lycopodiales. The Lycopodiaceae, Selaginellaceae, Isoëtaceae and Psilotaceae (plants usually known as 'fern-allies') have been until recently classed all together as Lycopodiales. As a result, however, of recent investigations the Psilotaceae (q.v.) must either be brought under the otherwise fossil class Sphenophyllales or constituted a separate class, Psilotales.

Lycopodiaceae (club-mosses) have no ligule at the base of the leaf, and are therefore called Eligulatae; they are included in two genera, *Lycopodium* and *Phylloglossum*. *Lycopodium* is represented in Australia by a number of species of which the principal are the handsome pendent *L. phlegmaria* of northern Queensland, *L. cernuum* (a pan-tropical species spreading from



Lycopodium cernuum.

northern Queensland into New South Wales), *L. laterale*, and *L. densum* (the so-called mountain moss), found in all the States except Western Australia. The characteristic of this genus is that its stem and branches are closely set with simple scale-like leaves, and usually possess terminal cones (strobili) which bear the kidney-shaped sporangia. The prothallium is a tiny tuberous body with a lobed fringe. *Phylloglossum Drummondi*, the single species of that genus, has a mature form very like the embryonic state of certain lycopods; it consists of a tubercle, a tuft of leaves and a stalk which terminates in a cone of sporangium-bearing leaves. The whole plant is very minute and has been considered a primitive form. It is limited, apparently, to Australia and New Zealand.

Selaginellaceae (a family limited to one genus, *Selaginella*) and Isoëtaceae are characterized by the presence of ligules at the base of the leaves. Nearly all selaginellas have their shoots dorsiventrally flattened, and their leaves in four rows —two rows of smaller overlapping leaves right and left of the medium dorsal line, and two rather larger ones along the edges of the stem. The sporangia are spherical, arising in the axils of the fertile leaves (collected into cones) and are of two kinds—megasporangia, with four megaspores, and microsporangia, which contain a large number of microspores. Sometimes the two kinds of sporangia are on different cones. There are several Australian species, the most common, perhaps, being *S. uliginosa;* it is found in all the States, as is also the moss-like *S. preissiana*. *S. australiensis* and *S. brisbanensis* are decumbent plants. *S. longipinna* (better known as *S. flabellata*) is a magnificent species, growing in dense dark-green patches alongside the creeks of northern Queensland. Two other species, *S. proniflora* (*S. Belangeri*) and *S. pumilio*, are also northern.

The Isoëtaceae have generally been linked with the Selaginellaceae under Lycopodiales Ligulatae, but Dr. Campbell considers the Isoëtaceae to be sufficiently distinct to warrant the establishment of a separate order, Isoëtales. *Isoëtes* has a very stunted stem and crowded quill-like leaves. There are no special fertile leaves, and consequently no cone; the stem is deeply grooved on its under surface; the sporangia, which are produced on the leaf, are very large, and contain a much larger number, not only of microspores, but of megaspores, than the allied families. The Australian species known to the writer are *I. Stuarti* and *I. elatior* from Tasmania, and *I. Drummondi* from Victoria.

W.W.W.

Lyne, SIR WILLIAM JOHN (1844-1913), born at Apslawn in Tasmania on 6 April 1844, in 1864 made a trial of pastoral life on the Gulf country in Queensland, but after a year returned to Tasmania and became shire-clerk of Glamorgan. In 1875 he reverted to a pastoral life, taking up land near Cumberoona on the Murray, and in 1880 entered New South Wales politics as member for the Hume (the upper Murray constituency); this seat he held till he left local for federal politics in 1901. Attaching himself to the protectionist party, in which he soon became a leading debater, he was secretary for public works in the Dibbs ministries of 1885 and 1891-4 and the Jennings ministry of 1886-7, and secretary for lands in the Dibbs ministry of 1889; in 1899, after five years of opposition (during which he led the anti-federationist section of the protectionist party), he succeeded George Reid (q.v.) as premier, and thus deprived him of the chance of becoming first prime minister of the Commonwealth. Lyne's career in the New South Wales parliament was marked by 'a singular mixture of good nature and wiliness' (to quote Sir George Reid), and his administration by events which created against him a strong suspicion of undue favouritism. He was undoubtedly a very able parliamentary tactician and, where he was at all friendly, a devoted friend. Though a member of the convention of 1897-8, his known opposition to federation of any kind rendered his influence on the debates of the convention almost nugatory, and the only suggestion by which he is remembered in that connection was one to make Sydney the federal capital—which was treated as a joke. As premier of New South Wales, however, he distinguished himself by proposing to send a contingent of troops to join the British forces engaged in the South African war—the first of many contingents despatched thither, which did valuable work and learnt useful lessons in the art of war. He also attempted to give women the franchise; but the bill was rejected by the council.

When Lord Hopetoun, the first governor-general of the Commonwealth, reached Australia, he was privately advised to offer the first prime ministership to the premier of the senior colony —i.e. to Lyne; behind this advice there was the hope that Lyne, being anti-federalist and little known in the other colonies, would prove an easily ousted prime minister. Lyne found himself unable to get together a sufficiently strong body of colleagues, and had to resign the task to Edmund Barton, who had long since been chosen for the post by an overwhelming public opinion. Barton took his defeated rival into his cabinet as minister for home affairs until August 1903, when on C. C. Kingston's resignation Lyne became minister for trade and customs. This de-

partment he continued to administer in the Deakin ministries of 1903-4 and 1905-8, though during the latter period he succeeded John Forrest as treasurer on 30 July 1907 and handed over the customs to Austin Chapman. As treasurer he carried through the customs tariff act of 1908, the first in which high protection combined with a marked preference for British goods was established as the policy of the Commonwealth.

The story of federal politics from 1903 to 1909 would include that of a persistent struggle between William Lyne and John Forrest for influence over Alfred Deakin. When in 1907 Deakin took Lyne with him to represent Australia at the Imperial conference of that year, it was understood that Lyne had won, and on the delegates' return Forrest left the ministry. But, when in November 1908 the Labour party withdrew that support by which alone the Deakin ministry had existed, Forrest's influence began to augment, and the Deakin-Cook fusion which expelled Labour from office in May 1909 was chiefly his work. Lyne therefore abandoned and bitterly attacked his former leader, and for the rest of his life remained a disappointed and disgruntled man. His work in the federal parliament had been irreproachable, if sometimes unenlightened, and in his last years he gained the sympathy of the bulk of his fellow representatives. He died at Sydney on 3 August 1913. (K.C.M.G., 1900.)

Lyre-birds, large terrestrial birds, constituting the family Menuridae, peculiar to south-eastern Australia. Their size, long legs, and stout toes, give lyre-birds a superficial resemblance to game birds, but structurally they are nearly related to the perching birds. By some authorities they are associated with scrub-birds (Atrichornithidae) in a sub-order called Passeres abnormales. By others they are classed by themselves in an order called Menuriformes.

The family contains a single genus, *Menura*, with two very distinct species. The Superb Lyre-bird (*M. novae-hollandiae*) inhabits the coastal areas from southern Queensland to eastern Victoria, chiefly occurring in forest country with thick undergrowth, especially tree-fern gullies among hills. The Albert Lyre-bird (*M. alberti*) is confined to the tropical scrubs of southern Queensland and the northern rivers of New South Wales; as these scrubs are being destroyed to make room for dairying and fruit-growing, it will probably soon be extinct.

Both sexes are slaty-brown in colour, the female having a long tail of normal feathers. In the male the central tail-feathers have long lateral filaments only, without barbs; the outer pair are curved first outwards, then inwards, and then sharply outwards at the tips. The inner edges of these two feathers are in the superb lyre-bird marked with triangular light-coloured transparent patches, but are uniform in the Albert lyre-bird, whose plumage is more rufous throughout.

The nest is a large domed structure, built in a tree-fern or on a stump; a single purple, blotched egg is laid. The breeding season is the middle of winter—perhaps in order that the young bird may be out of the nest before the destructive goanna wakes from his winter sleep.

Superb Lyre-bird.

The very powerful legs and claws are used in scratching up the ground and turning over logs, etc., in search of the insects, centipedes, crustacea, and snails on which the birds feed.

The cock-bird clears small circular areas in the scrub, and scratches up in the clearing a low mound of earth on which, either alone or before an audience of one or more hens, he sings, dances, and spreads his wonderful tail. Without question the lyre-bird is the best song-bird of Australia, its notes being peculiarly liquid and melodious; nor is there any doubt that as a mimic it is unrivalled throughout the world. Mixed with its song the listener may hear in succession the laugh of the kookaburra, the crack of the coach-whip-bird, the screaming of black cockatoos, the song of the harmonious thrush, the buzz of a circular saw, the whistle of a railway train, the howling of the dingo, and the hammering of nails, all imitated to the life. Indeed, its capacity for imitating any and every sound it may hear in the bush—with the sole exception of human speech—seems quite perfect. The hen bird, though not so powerful a songster as the cock, is also an accomplished mimic.

When first discovered (about 1799) the birds were called 'birds of paradise of New South Wales;' this cumbersome title gave place to the name 'native' or 'mountain pheasant,' bestowed by the settlers and still in use. About 1830 the name 'lyre-bird' began to be used, obviously because the tail is remarkably like the framework of a lyre. W.B.A.

Lyster, W. S. See MUSIC.

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